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FOUR COMPUTER CODES FOR DYNAMIC PROCESS INVENTORY DETERMINATION APPLICATION IN SAFEGUARDS

by

A. ROTA

1972

Joint Nuclear Research Centre
Ispra Establishment - Italy

Scientific Data Processing Centre - CETIS

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GROUP – For the optimization of the grouping of fuel elements to be reprocessed.

CC2 – For the computation of the contribution to the physical inventory of the "two component" mixture.

CC3 – For the computation of the contribution to the physical inventory of the "three component" mixture.

MUF – For the final evaluation of the Material Unaccounted. For and its error limits, within a prescribed confidence level.

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ABSTRACT

The following computer codes are described and listed. For each of them a sample program is solved.

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KEYWORDS

PROGRAMMING
INVENTORIES
SAFEGUARDS
MIXTURES
RELIABILITY
FUEL ELEMENTS
REPROCESSING

1. INTRODUCTORY REMARKS

The measurement of the physical inventory of Pu or/and U in a processing plant may be effectuated, during the running of the process, by the DPID technique (Dynamic Process Investory Determination) [1].

This report is only intended to present four computer codes, that have been written with the purpose of facilitating the implementation of the technique and the handling, in a proper way, of the experimental results. If the reader is interested either to the DPID theory or to the physical background of the codes themselves, he is kindly requested to consult the literature [2].

Copies of the codes, written in FORTRAN language, may be obtained on request from the CETIS Application Program Library.

The reader is supposed to be familiar with the terminology (e.g. batch, superbatch, step, tracer, etc.) inherent to the DPID technique. For this reason the meaning of these particular terms is not defined here and implicit reference is made to the literature [2].

2. THE CODE 'GROUP'

2.1. Outline

This code is designed to help the experimenter in the planning of the input dissolutions of the reprocessing plant, for a correct DPID. In fact, on the basis of the knowledge of the reactor calculation data, concerning the residual Pu and U isotopes present in the fuel elements, the code gives a series of tables, which serve as a guide to the best way of grouping the fuel elements in "dissolution batches". All the available isotopes are sequentially, selected as "tracer". The code may be utilized in two different ways, either to select, from the available material, two groups of dissolution batches (superbatches) with maximum difference of tracer concentration, or to select one group of dissolution batches with minimum variability of tracer concentration. The first solution is chosen when the isotope concentration step for the DPID occurs during the process of the material of one reactor, the second when the step is generated between the materials of two reactors.

2.2. Input data list

a - The first group of cards (format 20 A4) is a bloch of 8 FØRMATs; they must be written as follows: the underlined white spaces must contain the total number of isotopes considered (minimum 02, maximum 10)

```
(1H ,16X,'REACTOR DATA', ////,—(2X,2A4),'   FUEL EL. IDENT.'//)
(—F10.3,I4,4A4)
(8X,'FUEL ELEMENT IDENT.',—(2A4,1X),//)
(' ',I10,4A4,—6F9.5)
(/,' BATCH',I3,18X,—F9.5,//)
(1H ,///,' SUPERBATCH  MEAN VALUES ',—F9.5)
(13X,'STAND. DEV.   ',—F9.5)
(' ',I10,4A4,—F9.5,'   PU/U RATIO PERCENT= 'F7.5)
```

b - One card, format 5I10 with
NELEM = total number of fuel elements
NB1 = number of batches of first superbatch
NB2 = number of batches of second superbatch
MM = number of fuel elements per batch.

Note: if NB1 = 0 only one superbatch is determined with the higher homogenized tracer concentration. If NB2 = 0 only one superbatch is determined with the lower homogenized tracer concentration.

c - One card, format 5I10 with
ISU = number of U-isotopes considered (at least one)
ISP = number of Pu-isotopes considered (at least one)

Note: ISU + ISP $\leq$ 10
: when no Pu or U isotopes are available dummy figures must be introduced.

d - One card; format 5F10.0 with
FACTØR = ratio between the units in which the Pu and U isotopes are given (see group f).

Note: this value is important only for the determination of the Pu/U ratio.

e - One card; with the list of the names of the ISU + ISP considered. For each isotope a field of 8 alphanumeric characters is available. The U isotopes must precede the Pu ones. The maximum number of isotopes is 10.

f - Block of NELEM cards, format 10F6.0, I4,4A4. The fields I4 and 4A4 are available for proper number and name of the considered assembly a fuel element. The U-isotope quantities (expressed in any unit) present in the fuel element must be punched in the first ISU fields; the sequence must be referred to the one reported in card 'e'. In the following ISP field the analogous information for the Pu isotopes must be given.

2.3. Output description

The output of the code GROUP consists of the following set of results:

- Tables with the relevant input data
- A table with the list of the fuel elements available. For every element the isotopic content is expressed as relative aboundance. Also the (Total Pu)/(Total U) is provided.
- For every considered isotope (tracer), both of U and Pu, the following data are printed

  . The list of the elements ordered according to increasing concentration of the selected isotope.
  . The list (if any) of the elements not considered for the superbatches construction.
  . The list of the groups of elements of each batch of the first superbatch (minimum homogenized tracer concentration). The mean values of the isotope concentrations for each single batch and for the whole superbatch is given.
  . Same as before for superbatch two (maximum homogenized tracer concentration).

2.4. Remarks

The program has the following limitation: it has been designed for fuel elements having approximately the same U or Pu content, original enrichment and burn-up. The mean values calculated here are, for this reason, not verified. The algorithm used in the program does not ensure that the minimum of the variability or maximum of the difference in tracer concentration is actually achieved. The result is however very close to the optimum one. A more sophisticated program does not seem to be very necessary because of the uncertainty in the calculated reactor data, here used as inputs.
The program is written in double precision for the floating point variables.

3. THE CODE 'CC2'

3.1. Outline

The code CC2 evaluates the "two component mixture" contribution, H_2, to the process inventory. H_2 is given by:

$$H_2 = \sum_{J=1}^{NBATCH} M(J) \frac{X(J) - C2}{C1 - C2} \qquad (1)$$

where NBATCH is the number of the output batches, M(J) is the mass of fissile material (Pu or U) in the J-th output batch, X(J) is the relative abundance of the tracer in the same batch, C1 and C2 are the mean tracer concentrations in the two input super-batches.
The code supplies also a statistical interpretation of the parameter H_2. The uncertainty of H_2 is in fact connected to the experimental unaccuracy of the measured data and to the accepted extimate of C1 and C2. This error analysis is performed by a Monte Carlo procedure and the result is given as probability density function (pdf) of the dependent random variable H_2. Error limits around $\bar{H}_2$ are also estimated for preselected confidence levels.

3.2. Input data list

a - One card as follows:

** INPUT BATCH DATA **

== The sequence b- to f- must be repeted two times, for the first and the second superbatch respectively (K=1,2)

b - One card, format 20A4, with the name of the superbatch (e.g. REACTOR CANDU)

c - One card as follows:

BATCH TOTAL — (—) ——— PERC WEIGHT FACTOR

In the first underlined field the element name (PU or U) must be written; in the second the mass unit in the third the tracer name (e.g. Pu-241).

d - One card, format I10, containing NB(K), the number of batches of the K-th superbatch.

e - NB(K) cards, format 2F10.0; every card represents one batch and contains, in sequence, the following data:

- the total mass of the fissile element contained in the batch
- the tatal mass of the tracer in the batch

f - One card as follows:

REACTOR BATCH NUMB. MEAN PERC.T CONCENT.N

== At the end of the two sequences continue as follows:

g - One card as follows:

** OUTPUT BATCH DATA **

h - One card, format I10, with the number NBATCH, of output batches.

i - One card as follows:

N MASS MASS-SD ——— ———SD

In the underlined fields the name of the tracer isotope (see c-) must be inserted twice.

j - NBATCH cards, format 4F10.4. Every card contains, in the order, the following information of the output batch: (J=1,NBATCH)

- M (J), as described in paragraph 3.1.
- Experimental standard error of M(J)
- X(J), as described in paragraph 3.1.
- Experimental standard deviation of X(J).

k - One card as follows:

** STATISTICAL ANALYSIS INPUT DATA **

l - One card, format I10, containing an integer odd number for the initialization of the routine SETRAND.

m - One card, format F10.0, containing an integer odd number for the inizialization of the routine RANDU.

n - One card, format I10, containing the number of the histories for the Monte Carlo procedure.

o - One card, format 2F10.0, with QMS and DM:

QMS = range, expressed in the mass units, in which the pdf will be calculated.

DM = step lenght, expressed in mass units, in which the histogram of the pdf will be determined.

Note that the QMS/DM cannot exceed 60.

p - One card, format I10, with NCL, the number of predetermined probability values for which the error limit is requested ($NCL \leq 20$).

q - As many cards are necessary to write, with format 5F10.0, the NCL probability values, P(I), mentioned under p-. The P(I) values must be written in increasing order.

r - One card containing the figure 777 (starting from column 8) if punched cards with the pdf histogram are required. Any other number (or a blank card) means that punched results are not required.

3.3. Output description

The output of the CC2 code provides the following information.

- A series of tables containing the input data (Relevant parameters of the input and output batches).
- The values of H_2, calculated according to formula (1)
- The following information on H_2, interpreted as a random variable:
  - histogram of the frequencies
  - histogram and rough plot of the derived pdf
  - histogram and rough plot of the distribution function
  - table with the relevant data of the statistical analysis
  - table for the definition of the error limits at prescribed confidence levels: they are the values X_I solutions of the equation:

$$P(I) = \int^{X_I} \text{pdf}\,(H_2)dH_2 \qquad (2)$$

- On request (see part r of 3.2) a punched deck with the results of the statistical analysis is delivered. This deck may be used as input for the MUF code (see 5.2).

4. THE CODE 'CC3'

4.1. Outline

The code CC3 evaluates the "three component mixture" contribution, H_3, to the process inventory:

$$H_3 = \sum_{J=1}^{NBATCH} M(J) \frac{T(J)}{D} \qquad (3)$$

NBATCH is the number of the output batches taken into account; M(J) is the mass of fissile material (Pu or U) of the J-th output batch,

$$T(J) = \begin{vmatrix} 1 & 1 & 1 \\ x_j & c_2 & c_3 \\ Y_J & d_2 & d_3 \end{vmatrix}$$

$$D = \begin{vmatrix} 1 & 1 & 1 \\ c_1 & c_2 & c_3 \\ d_1 & d_2 & d_3 \end{vmatrix}$$

x_j and Y_J are the relative aboundances of the first and second tracer in the J-th output batch, c_h, d_h (h = 1, 2, 3) are the relative aboundances of the first and second tracer in the three input superbatches.
The code CC3 is very similar to the CC2: the statistical interpretation of H_3 is performed following the same outlines; the Monte Carlo technique is again used; and limits around $\bar{H}_3$ are estimated for preselected confidence levels.

4.2. Input data list

a - One card, as follows:

** INPUT BATCH DATA **

== The sequence from b- to f- must be repeat three times. Every run is specific for the input data characterizing one superbatch (K = 1, 2, 3).

b - One card, format 20A4, with the superbatch name (e.g. REACTOR TRINO)

c - One card as follows:

BATCH — MASS (—) ——— CONC. ——— CONC.

In the four underlined fields the following alphanumeric symbols must be introduced

- the fissile element name (PU or U)
- the mass unit (G or KG)
- the name of the first tracer (e.g. PU-241)
- the name of the second tracer (e.g. PU-242)

d - One card, format I10, containing NB(K), the number of batches of the K-th superbatch

e - NB(K) cards, format 3F10.0; every card represents on batch and contains, in sequence, the following data:

- the total mass of the element contained in the batch
- the total mass of the first tracer in the batch
- the total mass of the second tracer in the batch.

f - One card, as follows:

== At the end of the three sequences, continue as follows:

g - One card, as follows:

** OUTPUT BATCH DATA **

h - One card, as follows:

— MASS (—) ——— CONC. ——— CONC.

In the underlined fields the same symbols inserted in the c-card must be introduced.

i - One card, as follows:

NO. VALUE ST.DEV. PERCENT ST.DEV. PERCENT ST.DEV.

j - One card, format I10, with the number NBATCH of output batches.

k - NBATCH cards, format 6F10.4. Every card represents one batch (J=1, NBATCH) and contains the following sequence of data:

- M (J) (see 4.1.)
- Standard deviation of M(J)

. x_j (see 4.1) expressed in weight %
. Standard deviation of x_j
. Y_J (see 4.1) expressed in weight %
. Standard deviation of Y_J

== The final group of input data cards is identical to that of CC2 (from item K- to item r- of paragraph 3.2). Also the meaning of the variables is the same, so that this sequence is not repeated here.

4.3. Output description

The output of the CC3 code provides the following information:

- A series of tables containing the input data (Relevant parameters of input and output batches)
- The value of H_3, calculated according to formula (3)
- The following information on H_3, interpreted as a random variable:
  . relevant data of the pdf of H_3
  . table for the definition of the error limits at prescribed confidence levels (see 3.3)
  . histogram of the frequences
  . histogram and rough plot of the pdf
  . histogram and rough plot of the distribution function.
- On request, a punched deck with the results of the statistical analysis is delivered. This deck may be used as input for the MUF code (see 5.2).

5. THE CODE 'MUF'

5.1. Outline

The DPID supply one of the two terms for the determination of the Material Unaccounted For (MUF). This term is the value of the physical inventory:

$$PI = H_1 + H_2 \ (+ H_3) \qquad (4)$$

The PI is the sum of the two (or three) terms H_j, the "j-component" mixture contribution (for H_2 and H_3 see respectively ch. 3 and 4).
The MUF is defined by the relationship:

$$MUF = BI - PI \qquad (5)$$

where BI is the value of the inventory, as obtained from the accountings for inputs and outputs (Book Inventory).
As far as all the involved parameters can be interpreted as random realizations of unknown quantities, it is possible to define, for each of them, a pdf (the pdf.s of H_1 and BI are assumed to be normal; the ones of H_2 and H_3 are calculated, as histograms, by the codes CC2 and CC3; analytical expressions are not available).
The calculation of the pdf and of the distribution of PI and MUF is obtained by convolutions of the type here described.
Let p and q be independent random variables and f_1 and f_2 the corrisponding pdf.s. The analytical expressions for the pdf.s of the random variables:

$$s = p+q$$
$$r = p-q$$

are given, respectively by the following convolution integrals:

$$g(s) = \int f_1(t).f_2(s-t)dt$$

$$h(r) = \int f_1(r+t).f_2(t)dt$$

As far as, in the present case the f are, or may be expressed, in form of histograms, the above integrals are discretized as follows:

$$G(S) = \sum_{K1}^{K2} {}_K \; F1(K).F2(S-K) \qquad (6)$$

$$H(R) = \sum_{J1}^{J2} {}_J \; F1(R+J).F2(J)$$

(The capital letters used for the function names and variables corresponds to the small letters, which indicate continuous function and variables).

Let N_{11}, $N_{12}(N_{11} < N_{12})$ define the integer interval outside which F1 is identically zero and let $N_{21}, N_{22}(N_{21} < N_{22})$ have the same meaning for F2. From these limits it is possible to deduce analogous intervals for the functions G and H:

$$N_{11} + N_{21} < S < N_{12} + N_{22}$$

$$N_{11} - N_{22} < R < N_{12} - N_{21}$$

It is useless to include in the sums (6) those terms that certainly do not give any contribution, the sum limits results defined then as follows:

$$K1 = \text{Max } (N_{11},\ S-N_{22})$$
$$K2 = \text{min } (N_{12},\ S-N_{21})$$
$$J1 = \text{Max } (N_{21},\ N_{11}-R)$$
$$J2 = \text{min } (N_{22},\ N_{12}-R)$$

The MUF code makes use of these relationships to calculate the pdf.s, which are associated to the values of PI and MUF, as obtained by (4) and (5).
Actually this code may be used in a more general way: it calculates the pdf of any random variable, when

a) The random variable is an algebric sum of independent random variables

b) The pdf.s of these independent random variables are known.

The calculation is performed as a sequence of convolutions: a first pdf, relative to the random variable v_1 is defined; a second pdf, relative to the random variable v_2 is defined, together with the operation that must be executed on the variables themselves ($v_1 + v_2$, $v_1 - v_2$, $v_2 - v_1$). The program calculates the pdf of the sum and considers it as a new v_1, so that the sequence can be continued as far as necessary.
The code operates on pdf.s defined in form of histograms, so that the following remarks must be made:

- the histograms of the various pdf.s must have an unique value of the step lenght, PASSO (equal to the DM of codes CC2 and CC3).
- When the pdf of a variable is normal, and is defined by a mean value and a standard deviation, the code converts this continuous function in a histogram with the preselected value of the step. The range $\pm 3\ \sigma$ is considered.

For every convolution performed the code prints: the resulting pdf, with its relevant data and, on request, a rough plot and particular values of the distribution function for the definition of the error limits at preselected confidence levels.

5.2. Input data list

a - One card, format F10.0, with the value of PASSO.

b - One card, format I10, with the number of preselected values, P(I), for which a value of the resulting random variable must be calculated.

c - As many cards are necessary to write, with a format 5F10.0 and in ascending order the values of P(I).

d - A group of cards which define the pdf of the first variable, v_1, this sequence of cards is described at the end of this paragraph.

e - One card, format 1A3, chosen among the following:

+	The operation between the random variables v_1 (defined above) and v_2 (defined in the following) is $v_1 + v_2$
1-2	The operation is $v_1 - v_2$
2-1	The operation is $v_2 - v_1$
ALT	No more convolutions are required.

f - One card, format I10. When it contains the integer 777, it means that the error limits defined by cards b - and c - are requested.
Any other integer number can be introduced when no request in this sense is made.

g - One card, format I10. When it contains the integer 888, it means that a rough plot of the resulting pdf and distribution function are requested. Otherwise any other number (or blank) must be written.

h - A group of cards, identical to the group mentioned as item d -, which defines the pdf of the variable v_2. The details are given in the following.

== Here a loop begins, because the variable v_1 is now redefined, by the program, as result of the operation performed. A new group of cards, from item e - on, must be inserted, and they describe a new convolution, except when a ALT appears as card of e - type. In this case this is the last card of the input deck.

=== Sequence of cards for the definition of the pdf of a random variable:

i. One card, format I10, with the number, N, of the points in which the pdf of the variable is tabulated. When N = 999 it means that the variable has a normal distribution and that only the card iv must follow.

ii. One card, format 3F10.0, with the following three figures.

. central abscissa of the first step of the given histogram

. mean value of the variable
. standard deviation of the pdf. This last value is not used for computations, but only registered as a relevant parameter of the function.

iii. A group of cards, as necessary, format 5F12.0, to write the N values of the histogram (end of the sequence).

iv. One card to be used after card i. when N = 999. Format 2F10.0. It contains:

. The mean value and
. the standard deviation of the pdf (end of the sequence).

5.3. Output description

For every convolution the following output is given:

- a table with
  . the relevant data and the histogram of the pdf of the first variable
  . the relevant data and the histogram of the pdf of the second variable
  . the type of operation performed between the two variables (+, 1-2, 2-1).

  Note that from the second convolution on, the first variable is the one resulting from the preceding operation.
- A table with
  . the resulting pdf
  . the resulting distribution function
  . a list of the relevant data of the resulting pdf.
- A table (optional) with the error limits at prescribed confidence levels.
- Two rough plots (optional) of the pdf and of the distribution function.

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```
C
C
C      COMPUTER CODE GROUP
C
C
      IMPLICIT REAL*8(A-E,G,O-Z)
      DIMENSION NAME(2,10),IDENT(100,4)
      DIMENSION GU(100,5),GP(100,5),P(100,10),A(100,10),B(100,10)
      DIMENSION TU(100),TP(100),B1(10),B2(10),PUUR(100)
      DIMENSION KKK(50,10),JJJ(50,10),LL(100),KK(100)
      DIMENSION X(100,2)
C
C      FORMATS
C
      WRITE (6,215)
  101 FORMAT(5I10)
  102 FORMAT (5F10.0)
  104 FORMAT (20A4)
  105 FORMAT (10F6.0,I4,4A4)
C
      DIMENSION FMT0(20)
      READ (5,104) FMT0
  300 FORMAT (1H ,'   FMT0    ',20A4)
      WRITE (6,300) FMT0
      DIMENSION FMT1(20)
      READ (5,104) FMT1
  301 FORMAT (1H ,'   FMT1    ',20A4)
      WRITE (6,301) FMT1
  202 FORMAT (1H1,
     1        ' OMOGENEIZATION ACCORDING ISOTOPE ***',2A4,'  ***',///)
      DIMENSION FMT3(20)
      READ (5,104) FMT3
  303 FORMAT (1H ,'   FMT3    ',20A4)
      WRITE (6,303) FMT3
      DIMENSION FMT4(20)
      READ (5,104) FMT4
  304 FORMAT (1H ,'   FMT4    ',20A4)
      WRITE (6,304) FMT4
      DIMENSION FMT5(20)
      READ (5,104) FMT5
  305 FORMAT (1H ,'   FMT5    ',20A4)
      WRITE (6,305) FMT5
      DIMENSION FMT6(20)
      READ (5,104) FMT6
  306 FORMAT (1H ,'   FMT6    ',20A4)
      WRITE (6,306) FMT6
      DIMENSION FMT7(20)
      READ (5,104) FMT7
```

```
0039          307 FORMAT (1H ,'   FMT7     ',20A4)
0040              WRITE (6,307) FMT7
0041              DIMENSION FMT8(20)
0042              READ (5,104) FMT8
0043          308 FORMAT (1H ,'   FMT8     ',20A4)
0044              WRITE (6,308) FMT8
0045          209 FORMAT (1H1,'    ERRORE NEI DATI   ***  NELEM1,NG1 = ',2I4)
0046          210 FORMAT (16X,'LIST OF REJECTED ELEMENTS',///)
0047          211 FORMAT (///,16X,'FIRST SUPERBATCH',///)
0048          212 FORMAT (///,16X,'SECOND SUPERBATCH',///)
0049          213 FORMAT (1H1)
0050          214 FORMAT (1H1,12X,'** DATA OF THE PROBLEM **',////,
                 1'  TOTAL NUMBER OF AVAILABLE ELEMENTS       ',I5,/,
                 2'  NUMBER OF ELEMENTS PER DISSOLUTION       ',I5,/,
                 3'  NUMBER OF BATCHES IN FIRST SUPERBATCH    ',I5,/,
                 4'  NUMBER OF BATCHES IN SECOND SUPERBATCH   ',I5,/,
                 5'  NUMBER OF URANIUM ISOTOPES CONSIDERED    ',I5,/,
                 6'  NUMBER OF PLUTONIUM ISOTOPES CONSIDERED  ',I5,/,
                 7'  RATIO PU-WEIGHT-UNIT/U-WEIGHT-UNIT      ',F6.0,/////)
0051          215 FORMAT (12X,'** VARIABLE FORMAT LIST **',////)
0052          216 FORMAT ('  ELEMENTS ORDERED ACCORDING ENCREASING CONCENTRATION OF
                1 THE SELECTED ISOTOPE',2A4,///)
              C
              C READ DATA
              C
0053              READ (5,101) NELEM,NB1,NB2,MM
0054              NELEM1=NB1*MM
0055              NELEM2=NB2*MM
0056              AL=MM
0057              READ (5,101) ISU,ISP
0058              READ (5,102) FACTOR
0059              WRITE (6,214) NELEM,MM,NB1,NB2,ISU,ISP,FACTOR
0060              NIS=ISU+ISP
0061              FACTOR=100./FACTOR
0062              READ (5,104) ((NAME(I,K),I=1,2),K=1,NIS)
0063              ITT=10-ISU
0064              AIS=NIS
0065              WRITE (6,FMT0) ((NAME(I,K),I=1,2),K=1,NIS)
              C
              CC
              C
0066              DO 8 IX=1,NELEM
0067              READ (5,105) ((GU(IX,IU),IU=1,ISU),(GP(IX,IP),IP=1,ITT),
                 1KK(IX),(IDENT(IX,IT),IT=1,4))
0068               WRITE(6,FMT1) ((GU(IX,IU),IU=1,ISU),(GP(IX,IP),IP=1,ISP),
                 1KK(IX),(IDENT(IX,IT),IT=1,4))
              C
              C     DETERMINATION OF THE ISOTOPIC CONCENTRATIONS
```

```
      C
0069        TU(IX)=0.
0070        TP(IX)=0.
0071        DO 4 IS=1,ISU
0072        TU(IX)=TU(IX)+GU(IX,IS)
0073      4 CONTINUE
0074        DO 5 IS=1,ISP
0075        TP(IX)=TP(IX)+GP(IX,IS)
0076      5 CONTINUE
0077        PUUR(IX)=(TP(IX)/TU(IX))*FACTOR
0078        DO 6 IS=1,ISU
0079        P(IX,IS)=GU(IX,IS)/TU(IX)
0080      6 CONTINUE
0081        DO 7 IS=1,ISP
0082        ISS=ISU+IS
0083        P(IX,ISS)=GP(IX,IS)/TP(IX)
0084      7 CONTINUE
0085      8 CONTINUE
0086        WRITE (6,213)
0087        WRITE (6,FMT3) ((NAME(I,K),I=1,2),K=1,NIS)
0088        DO 2 IX=1,NELEM
0089        WRITE (6,FMT8) (IX,(IDENT(IX,IT),IT=1,4),(P(IX,IS),IS=1,NIS),
           1PUUR(IX))
0090      2 CONTINUE
      C
      C
      C OMOGENEIZATION ACCORDING ISOTOPE 'ISS'
      C
0091        DO 999 ISS=1,NIS
      C
0092        DO 9 IS=1,10
0093        B1(IS)=0.
0094        B2(IS)=0.
0095        DO 9 J=1,100
0096        B(J,IS)=0.
0097      9 CONTINUE
      C
0098        WRITE (6,202) (NAME(I,ISS),I=1,2)
      C
      C     ORDERING OF FUELS ACCORDING ENCREASING CONCENTRATION OF 'ISS'
      C
0099        DO 10 IX=1,NELEM
0100        X(IX,1)=P(IX,ISS)
0101        X(IX,2)=FLOAT(IX)
0102     10 CONTINUE
0103        CALL NDOR2(NELEM,X)
      C
0104        WRITE (6,216) (NAME(I,ISS),I=1,2)
```

```
0105                WRITE (6,FMT3) ((NAME(I,K),I=1,2),K=1,NIS)
0106                DO 31 J=1,NELEM
0107                I=X(J,2)
0108                WRITE (6,FMT4) (J,(IDENT(I,IT),IT=1,4),(P(I,IS),IS=1,NIS))
0109             31 CONTINUE
                 C
                 CC     SUPERBATCH NUMBER 1
                 C
0110                WRITE (6,213)
                 C
0111                IF (NELEM1.EQ.0) GO TO 60
0112                N01=NELEM-NELEM2
0113                IF (NELEM1.GT.N01) GO TO 70
0114                IF (NELEM1.EQ.N01) GO TO 15
0115                N00=NELEM1+1
0116                WRITE (6,210)
0117                WRITE (6,FMT3) ((NAME(I,K),I=1,2),K=1,NIS)
0118                DO 72 IX=N00,N01
0119                I=X(IX,2)
0120                LL(IX)=I
0121                K=IX-N00+1
0122                WRITE (6,FMT4)(K,(IDENT(I,IT),IT=1,4),(P(I,IS),IS=1,NIS))
0123             72 CONTINUE
0124             15 CONTINUE
                 C
                 CC     FUEL DATA TRANSFERRED IN WORK MATRIX 'A'
                 C
0125                DO 14 IX=1,NELEM1
0126                I=X(IX,2)
0127                LL(IX)=I
0128                DO 12 IS=1,NIS
0129                A(IX,IS)=P(I,IS)
0130             12 CONTINUE
0131             14 CONTINUE
                 C
0132                CALL SUPBCH(NELEM1,A,LL,KKK,NB1,NIS,B,ISS)
                 C
                 CC     FINAL BATCH COMPOSITIONS
                 C
0133                WRITE (6,211)
0134                WRITE (6,FMT3) ((NAME(I,K),I=1,2),K=1,NIS)
0135                DO 62 J=1,NB1
0136                DO 50 I=1,MM
0137                K=KKK(J,I)
0138                WRITE (6,FMT4) ( K,(IDENT(K,IT),IT=1,4),(P(K,IS),IS=1,NIS))
0139             50 CONTINUE
0140                DO 54 IS=1,NIS
0141                B(J,IS)=B(J,IS)/AL
```

```
0142                B1(IS)=B1(IS)+B(J,IS)
0143                B2(IS)=B2(IS)+B(J,IS)*B(J,IS)
0144             54 CONTINUE
0145                WRITE (6,FMT5) (   J,(B(J,IS),IS=1,NIS))
0146             62 CONTINUE
                 C
                 C     SUPERBATCH CHARACTERISTICS
                 C
0147                BB1=NB1
0148                DO 66 IS=1,NIS
0149                B1(IS)=B1(IS)/BB1
0150                B2(IS)=DSQRT((B2(IS)-BB1*B1(IS)*B1(IS))/(BB1-1.))
0151             66 CONTINUE
0152                WRITE (6,FMT6) (B1(IS),IS=1,NIS)
0153                WRITE (6,FMT7) (B2(IS),IS=1,NIS)
                 C
0154             60 CONTINUE
                 C
0155                IF (NELEM2.EQ.0) GO TO 999
                 C
                 C     SUPERBATCH NUMBER 2
                 C
0156                NO3=NELEM-NELEM2
0157                IF (NELEM1.NE.0) GO TO 87
0158                WRITE (6,210)
0159                WRITE (6,FMT3) ((NAME(I,K),I=1,2),K=1,NIS)
0160                DO 61 IX=1,NO3
0161                I=X(IX,2)
0162                LL(IX)=I
0163                K=IX
0164                WRITE (6,FMT4)(K,(IDENT(I,IT),IT=1,4),(P(I,IS),IS=1,NIS))
0165             61 CONTINUE
0166             87 CONTINUE
                 C
0167                DO 48 IS=1,10
0168                B1(IS)=0.
0169                B2(IS)=0.
0170                DO 48 J=1,100
0171                B(J,IS)=0.
0172             48 CONTINUE
                 C
                 C     FUEL DATA TRANSFERRED IN WORK MATRIX 'A'
                 C
0173                DO 80 IX=1,NELEM2
0174                NO4=NO3+IX
0175                I=X(NO4,2)
0176                LL(IX)=I
0177                DO 80 IS=1,NIS
```

```
0178                  A(IX,IS)=P(I,IS)
0179               80 CONTINUE
                   C
0180                  CALL SUPBCH(NELEM2,A,LL,KKK,NB2,NIS,B,ISS)
                   C
                   C     SECOND SUPERBATCH CHARACTERISTICS
                   C
0181                  WRITE (6,212)
0182                  WRITE (6,FMT3) ((NAME(I,K),I=1,2),K=1,NIS)
0183                  DO 63 J=1,NB2
0184                  DO 51 I=1,MM
0185                  K=KKK(J,I)
0186                  WRITE (6,FMT4) ( K,(IDENT(K,IT),IT=1,4),(P(K,IS),IS=1,NIS))
0187               51 CONTINUE
0188                  DO 55 IS=1,NIS
0189                  B(J,IS)=B(J,IS)/AL
0190                  B1(IS)=B1(IS)+B(J,IS)
0191                  B2(IS)=B2(IS)+B(J,IS)*B(J,IS)
0192               55 CONTINUE
0193                  WRITE (6,FMT5) (   J,(B(J,IS),IS=1,NIS))
0194               63 CONTINUE
                   C
                   C     SUPERBATCH CHARACTERISTICS
                   C
0195                  BB2=NB2
0196                  DO 67 IS=1,NIS
0197                  B1(IS)=B1(IS)/BB2
0198                  B2(IS)=DSQRT((B2(IS)-BB2*B1(IS)*B1(IS))/(BB2-1.))
0199               67 CONTINUE
0200                  WRITE (6,FMT6) (B1(IS),IS=1,NIS)
0201                  WRITE (6,FMT7) (B2(IS),IS=1,NIS)
                   C
0202              999 CONTINUE
                   C
0203                  GO TO 1000
0204               70 CONTINUE
0205                  WRITE (6,209) NELEM1,NB1
0206             1000 CONTINUE
0207                  STOP
0208                  END
```

```
      C
0001        SUBROUTINE NDOR2(N,X)
0002        IMPLICIT REAL*8(A-H,O-Z)
0003        DIMENSION X(100,2)
      C
0004        DO 5 I=2,N
0005        IF(X(I,1)-X(I-1,1)) 1,5,5
0006      1 TEMP1=X(I,1)
0007        TEMP2=X(I,2)
0008        IM1=I-1
0009        DO 3 J=1,IM1
0010        L=I-J
0011        IF(TEMP1-X(L,1)) 2,4,4
0012      2 X(L+1,1)=X(L,1)
0013        X(L+1,2)=X(L,2)
0014      3 CONTINUE
0015        X(1,1)=TEMP1
0016        X(1,2)=TEMP2
0017        GO TO 5
0018      4 X(L+1,1)=TEMP1
0019        X(L+1,2)=TEMP2
0020      5 CONTINUE
      C
0021        RETURN
0022        END
```

```
0001            SUBROUTINE SUPBCH(NELEM,A,LL,KKK,M,NIS,B,ISS)
                C
0002            IMPLICIT REAL*8 (A-E,G,O-Z)
                C
0003            DIMENSION A(100,10),LL(100),KKK(50,10),B(100,10)
0004            DIMENSION X(100,2),JJJ(50,10)
                C
0005            N=NELEM
0006            L=1
                C
                C     INITIALIZATION OF FINAL BATCHES 'B'
                C
0007            DO 16 I=1,M
0008            KKK(I,1)=LL(I)
0009            DO 16 IS=1,NIS
0010            B(I,IS)=A(I,IS)
0011         16 CONTINUE
                C
                C     SUBSEQUENT ADDITION TO FINAL BATCHES OF SINGLE FUEL ELEMENTS
                C
0012         20 CONTINUE
                C
0013            L=L+1
                C
0014            DO 24 I=1,M
0015            J=N-I+1
0016            KKK(I,L)=LL(J)
0017            DO 24 IS=1,NIS
0018            B(I,IS)=B(I,IS)+A(J,IS)
0019         24 CONTINUE
                C
                C     TEST OF END OF GROUPING
0020            IF (M.EQ.(N-M)) GO TO 46
                C
                C     ORDERING OF 'B' GROUPS ACCORDING ENCREASING VALUES OF 'ISS' CONCENTRATIONS
                C
0021            DO 26 I=1,M
0022            X(I,1)=B(I,ISS)
0023            X(I,2)=FLOAT(I)
0024         26 CONTINUE
0025            CALL NDOR2(M,X)
0026            DO 34 I=1,M
0027            DO 30 IS=1,NIS
0028            A(I,IS)=B(I,IS)
0029         30 CONTINUE
0030            DO 32 IL=1,L
0031            JJJ(I,IL)=KKK(I,IL)
0032         32 CONTINUE
```

```
      LIST OF THE DATA CARDS USED FOR THE 'ORDER' SAMLE PROGRAM
...

(1H ,16X,'REACTOR DATA',////,6(2X,2A4),'   FUEL EL- IDENT.',//)
( 6F10.3,I4,4A4)
(8X,'FUEL ELEMENT IDENT.', 6(2A4,1X),//)
(' ',I10,4A4, 6F9.5)
(/,' BATCH',I3,18X, 6F9.5,//)
(1H ,///,' SUPERBATCH  MEAN VALUES   ',6F9.5)
(13X,'STAND. DEV.    ', 6F9.5)
(' ',I10,4A4, 6F9.5,'    PU/U RATIO PERCENT= 'F7.5)
          40          8          3          3
           3          3
     100.
    U-235    U-236    U-238   PU-239   PU-240   PU 241
186.5 27.39 7960. 4505. 962. 527.2                    1*509-109 F10 100
170.6 30.22 7943. 4790. 1092. 675.6                   1*509-111 D10  49
169.8 30.36 7942. 4795. 1100. 683.4                   1*509-117 J09  59
121.5 26.57 7996. 4767. 1286. 727.0                   1 509-076 F04  94
122.1 26.47 7997. 4771. 1277. 721.2                   2 509-058 E05  88
123.3 26.26 7999. 4737. 1265. 709.5                   2 509-074 H04 109
122.1 26.46 7997. 4758. 1279. 719.2                   2 509-078 G09 107
124.7 26.02 8001. 4723. 1253. 693.4                   2 509-052 I07 117
122.4 26.43 7997. 4768. 1278. 719.6                   3 509-043 H08 113
120.6 26.72 7995. 4789. 1290. 734.6                   3 509-059 I04  68
118.5 27.05 7991. 4816. 1314. 760.5                   3 509-061 J04  65
124.1 26.14 8000. 4735. 1256. 695.8                   3 509-054 D08  86
116.8 27.34 7989. 4858. 1333. 785.2                   4 509-044 I09  58
116.7 27.32 7989. 4836. 1330. 779.5                   4 509-048 C08  45
115.7 27.50 7987. 4857. 1346. 796.1                   4 509-064 G10 108
122.2 26.76 7994. 4790. 1300. 743.5                   4 509-073 J06 119
116.4 27.40 7988. 4862. 1338. 790.2                   5 509-063 C05  80
114.9 27.63 7986. 4868. 1355. 806.5                   5 509-047 F03  93
117.7 27.17 7991. 4825. 1319. 767.8                   5 509-050 E09  92
122.0 26.47 7997. 4770. 1280. 722.2                   5 509-055 H06 111
116.6 27.35 7989. 4844. 1329. 786.8                   6 509-072 F06  96
115.6 27.51 7987. 4860. 1342. 795.5                   6 509-062 E10  50
117.1 27.27 7989. 4838. 1323. 774.2                   6 509-075 F08  98
116.7 27.32 7989. 4843. 1327. 778.8                   6 509-071 G07 105
126.0 25.81 8003. 4701. 1238. 677.1                   7 509-051 H10  55
129.0 25.29 8007. 4639. 1203. 640.1                   7 509-057 I05 115
126.4 25.73 8003. 4693. 1233. 671.7                   7 509-053 E03  75
122.7 26.37 7998. 4762. 1274. 715.5                   7 509-067 D06  84
174.3 29.57 7947. 4720. 1166. 637.0                   8*509-116 J03  66
173.6 29.76 7946. 4734. 1166. 644.5                   8*509-112 I03  69
171.6 30.04 7944. 4765. 1184. 664.5                   8*509-114 D03  76
122.8 26.49 7997. 4774. 1282. 723.7                   8 509-046 G05 103
115.5 27.53 7997. 4861. 1344. 796.9                   9 509-042 H03  78
118.3 27.06 7991. 4819. 1311. 759.5                   9 509-045 E07  90
120.8 26.66 7995. 4783. 1292. 735.5                   9 509-065 C07  82
171.5 30.07 7944. 4768. 1085. 666.0                  10*509-118 C04  79
171.3 30.09 7943. 4776. 1086. 667.9                  10*509-115 C09  46
170.6 30.21 7943. 4782. 1093. 674.8                  10*509-113 I10  56
116.9 27.29 7989. 4845. 1327. 778.8                1000. 509-069. D04.. 78
114.1 27.77 7985. 4895. 1363. 819.6                1000. 509-041 J08.. 60
```

** VARIABLE FORMAT LIST **

```
FMT0    (1H ,16X,'REACTOR DATA',////,6(2X,2A4),'   FUEL EL. IDENT.',//)
FMT1    ( 6F10.3,I4,4A4)
FMT3    (8X,'FUEL ELEMENT IDENT.', 6(2A4,1X),//)
FMT4    (' ',I10,4A4, 6F9.5)
FMT5    (/,' BATCH',I3,18X, 6F9.5,//)
FMT6    (1H ,///,' SUPERBATCH  MEAN VALUES   ',6F9.5)
FMT7    (13X,'STAND. DEV.    ', 6F9.5)
FMT8    (' ',I10,4A4, 6F9.5,'   PU/U RATIO PERCENT= 'F7.5)
```

** DATA OF THE PROBLEM **

TOTAL NUMBER OF AVAILABLE ELEMENTS	45
NUMBER OF ELEMENTS PER DISSOLUTION	3
NUMBER OF BATCHES IN FIRST SUPERBATCH	8
NUMBER OF BATCHES IN SECOND SUPERBATCH	3
NUMBER OF URANIUM ISOTOPES CONSIDERED	3
NUMBER OF PLUTONIUM ISOTOPES CONSIDERED	3
RATIO PU-WEIGHT-UNIT/U-WEIGHT-UNIT	100.

REACTOR DATA

U-235	U-236	U-238	PU-239	PU-240	PU 241	FUEL EL. IDENT.
186.500	27.390	7960.000	4505.000	962.000	527.200	1*509-109 F10 100
175.600	30.220	7943.000	4790.000	1092.000	675.600	1*509-111 D10 49
169.800	30.360	7942.000	4795.000	1100.000	683.400	1*509-117 J09 59
121.500	26.570	7996.000	4767.000	1286.000	727.000	1 509-076 F04 94
122.100	26.470	7997.000	4771.000	1277.000	721.200	2 509-058 E05 88
123.300	26.260	7999.000	4737.000	1265.000	703.500	2 509-074 H04 109
122.100	26.460	7997.000	4758.000	1279.000	719.200	2 509-078 G09 107
124.700	26.020	8001.000	4723.000	1253.000	693.400	2 509-052 I07 117
122.400	26.430	7997.000	4768.000	1278.000	719.600	3 509-043 H08 113
120.600	26.720	7995.000	4789.000	1290.000	734.600	3 509-059 I04 68
118.500	27.050	7991.000	4816.000	1314.000	760.500	3 509-061 J04 65
124.100	26.140	8000.000	4735.000	1256.000	695.800	3 509-054 D08 86
116.800	27.340	7989.000	4858.000	1333.000	785.200	4 509-044 I09 58
116.700	27.320	7989.000	4836.000	1330.000	779.500	4 509-048 C08 45
115.700	27.500	7987.000	4857.000	1346.000	796.100	4 509-064 G10 108
120.200	26.760	7994.000	4790.000	1300.000	743.500	4 509-073 J06 119
116.400	27.400	7988.000	4862.000	1338.000	790.200	5 509-063 C05 80
114.900	27.630	7986.000	4868.000	1355.000	806.500	5 509-047 F03 93
117.700	27.170	7991.000	4825.000	1319.000	767.800	5 509-050 F09 92
122.000	26.470	7997.000	4770.000	1280.000	722.200	5 509-055 H06 111
116.600	27.350	7989.000	4844.000	1329.000	780.800	6 509-072 F06 96
115.600	27.510	7987.000	4860.000	1342.000	795.500	6 509-062 E10 50
117.100	27.270	7989.000	4838.000	1323.000	774.200	6 509-075 F08 98
116.700	27.320	7989.000	4843.000	1327.000	778.800	6 509-071 G07 105
126.000	25.810	8003.000	4701.000	1238.000	677.100	7 509-051 H10 55
129.000	25.290	8007.000	4639.000	1203.000	640.100	7 509-057 I05 115
126.400	25.730	8003.000	4693.000	1233.000	671.700	7 509-053 E03 75
122.700	26.370	7998.000	4762.000	1274.000	715.500	7 509-067 D06 84
174.300	29.570	7947.000	4720.000	1065.000	637.000	8*509-116 J03 66
173.600	29.700	7946.000	4734.000	1066.000	644.500	8*509-112 I03 69
171.600	30.040	7944.000	4765.000	1084.000	664.500	8*509-114 D03 76
122.000	26.490	7997.000	4774.000	1282.000	723.700	8 509-046 G05 103
115.500	27.530	7987.000	4861.000	1344.000	796.900	9 509-042 H03 78
118.300	27.060	7991.000	4815.000	1311.000	759.500	9 509-045 E07 90
120.800	26.660	7995.000	4783.000	1292.000	735.500	9 509-065 C07 82
171.500	30.070	7944.000	4768.000	1085.000	666.000	10*509-118 C04 79
171.300	30.090	7943.000	4776.000	1086.000	667.900	10*509-115 C09 46
170.600	30.210	7943.000	4782.000	1093.000	674.800	10*509-113 I10 56
116.900	27.290	7989.000	4845.000	1327.000	778.800	1000. 509-069. D04.. 78

114.100 27.770 7985.000 4895.000 1363.000 819.6001000.509-041 J08..60

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241	
1*509-109 F10 100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789	PU/U RATIO PERCENT= 0.73382
2*509-111 D10 49	0.02095	0.00371	0.97534	0.73445	0.16652	0.10303	PU/U RATIO PERCENT= 0.80522
3*509-117 J09 59	0.02085	0.00373	0.97542	0.72893	0.16721	0.10389	PU/U RATIO PERCENT= 0.80794
4 509-076 F04 . 94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723	PU/U RATIO PERCENT= 0.83251
5 509-058 E05 88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654	PU/U RATIO PERCENT= 0.83103
6 509-074 H04 109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491	PU/U RATIO PERCENT= 0.82291
7 509-078 G09 107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645	PU/U RATIO PERCENT= 0.82943
8 509-052 I07 117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397	PU/U RATIO PERCENT= 0.81816
9 509-043 H08 113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636	PU/U RATIO PERCENT= 0.83056
10 509-059 I04 68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781	PU/U RATIO PERCENT= 0.83681
11 509-061 J04 65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037	PU/U RATIO PERCENT= 0.84686
12 509-054 D08 86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406	PU/U RATIO PERCENT= 0.82044
13 509-044 I09 58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255	PU/U RATIO PERCENT= 0.85775
14 509-048 C08 45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223	PU/U RATIO PERCENT= 0.85399
15 509-064 G10 108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374	PU/U RATIO PERCENT= 0.86088
16 509-073 J06 119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880	PU/U RATIO PERCENT= 0.83940
17 509-063 C05 80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304	PU/U RATIO PERCENT= 0.85961
18 509-047 F03 93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473	PU/U RATIO PERCENT= 0.86479
19 509-050 E09 92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109	PU/U RATIO PERCENT= 0.84955
20 509-055 H06 111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664	PU/U RATIO PERCENT= 0.83141
21 509-072 F06 96	0.01434	0.00336	0.98230	0.69662	0.19112	0.11228	PU/U RATIO PERCENT= 0.85502
22 509-062 E10 50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368	PU/U RATIO PERCENT= 0.86069
23 509-075 F08 98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163	PU/U RATIO PERCENT= 0.85268
24 509-071 G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208	PU/U RATIO PERCENT= 0.85439
25 509-051 H10 55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234	PU/U RATIO PERCENT= 0.81131
26 509-057 I05 115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875	PU/U RATIO PERCENT= 0.79425
27 509-053 F03 75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181	PU/U RATIO PERCENT= 0.80902
28 509-067 D06 84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598	PU/U RATIO PERCENT= 0.82870
29*509-116 J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927	PU/U RATIO PERCENT= 0.78728
30*509-112 I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001	PU/U RATIO PERCENT= 0.79280
31*509-114 D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10282	PU/U RATIO PERCENT= 0.79963
32 509-046 G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675	PU/U RATIO PERCENT= 0.83233
33 509-042 H03 70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381	PU/U RATIO PERCENT= 0.86124
34 509-045 E07 90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024	PU/U RATIO PERCENT= 0.84675
35 509-065 C07 82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800	PU/U RATIO PERCENT= 0.83642
36*509-118 C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216	PU/U RATIO PERCENT= 0.80031
37*509-115 C09 46	0.02102	0.00369	0.97527	0.73140	0.16631	0.10228	PU/U RATIO PERCENT= 0.80177
38*509-113 I10 56	0.02095	0.00371	0.97534	0.73013	0.16688	0.10303	PU/U RATIO PERCENT= 0.80427
39.509-069.D04.. 78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204	PU/U RATIO PERCENT= 0.85462
40.509-041 J08.. 60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580	PU/U RATIO PERCENT= 0.87089

CMOGENEIZATION ACCORDING ISOTOPE *** U-235 ***

ELEMENTS ORDERED ACCORDING ENCREASING CONCENTRATION OF THE SELECTED ISOTOPE U-235

	FUEL ELEMENT IDENT.		U-235	U-236	U-238	PU-239	PU-240	PU 241
1.	509-041	J08.. 60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580
2	509-047	F03 93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473
3	509-042	H03 70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
4	509-062	E10 50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
5	509-064	G10 108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
6	509-063	C05 80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
7	509-072	F06 96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
8	509-048	C08 45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
9	509-071	G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208
10	509-044	I09 58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
11.	509-069.	D04.. 78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204
12	509-075	F08 98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
13	509-050	E09 92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
14	509-045	E07 90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
15	509-061	J04 65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
16	509-073	J06 119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
17	509-059	I04 68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
18	509-065	C07 82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800
19	509-076	F04 94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
20	509-046	G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
21	509-055	H06 111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
22	509-058	E05 88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
23	509-078	G09 107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
24	509-043	H08 113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
25	509-067	D06 84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
26	509-074	H04 109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
27	509-054	D08 86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
28	509-052	I07 117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
29	509-051	H10 55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
30	509-053	E03 75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181
31	509-057	I05 115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875
32*	509-117	J09 59	0.02085	0.00373	0.97542	0.72890	0.16721	0.10389
33*	509-111	D10 49	0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
34*	509-113	I10 56	0.02095	0.00371	0.97534	0.73010	0.16688	0.10303
35*	509-115	C09 46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
36*	509-118	C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
37*	509-114	D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
38*	509-112	I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001
39*	509-116	J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
40*	509-109	F10 100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789

LIST OF REJECTED ELEMENTS

	FUEL ELEMENT IDENT.			U-235	U-236	U-238	PU-239	PU-240	PU 241
1	509-067	D06	84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
2	509-074	H04	109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
3	509-054	D08	86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
4	509-052	I07	117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
5	509-051	H10	55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
6	509-053	E03	75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181
7	509-057	I05	115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875

FIRST SUPERBATCH

	FUEL ELEMENT IDENT.			U-235	U-236	U-238	PU-239	PU-240	PU 241
40.	509-041	J08	60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580
9	509-043	H08	113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
16	509-073	J06	119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
BATCH 1				0.01461	0.00332	0.98207	0.69911	0.19057	0.11032
18	509-047	F03	93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473
7	509-078	G09	107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
11	509-061	J04	65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
BATCH 2				0.01456	0.00332	0.98211	0.69856	0.19092	0.11052
14	509-048	C08	45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
10	509-059	I04	68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
34	509-045	E07	90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
BATCH 3				0.01457	0.00332	0.98211	0.69954	0.19037	0.11009
21	509-072	F06	96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
35	509-065	C07	82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800
19	509-050	E09	92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
BATCH 4				0.01455	0.00333	0.98213	0.69899	0.19055	0.11045
33	509-042	H03	70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
5	509-058	E05	88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
23	509-075	F08	98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
BATCH 5				0.01453	0.00333	0.98214	0.69888	0.19045	0.11066
22	509-062	E10	50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
20	509-055	H06	111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
39.	509-069	D04	78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204

BATCH 6		0.01452	0.00333	0.98215	0.69864	0.19057	0.11079
15	509-064 G10 108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
32	509-046 G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
13	509-044 I09 58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
BATCH 7		0.01452	0.00333	0.98214	0.69816	0.19083	0.11101
17	509-063 C05 80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
4	509-076 F04 94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
24	509-071 G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208
BATCH 8		0.01453	0.00333	0.98214	0.69853	0.19068	0.11078
SUPERBATCH	MEAN VALUES	0.01455	0.00333	0.98212	0.69880	0.19062	0.11058
	STAND. DEV.	0.00003	0.00001	0.00003	0.00042	0.00018	0.00029

SECOND SUPERBATCH

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
38*509-113 I10 56	0.02095	0.00371	0.97534	0.73010	0.16688	0.10303
30*509-112 I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001
31*509-114 D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
BATCH 1	0.02111	0.00368	0.97521	0.73208	0.16624	0.10168
2*509-111 D10 49	0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
29*509-116 J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
36*509-118 C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
BATCH 2	0.02113	0.00368	0.97519	0.73247	0.16605	0.10149
3*509-117 J09 59	0.02085	0.00373	0.97542	0.72890	0.16721	0.10389
1*509-109 F10 100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789
37*509-115 C09 46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
BATCH 3	0.02157	0.00359	0.97484	0.73734	0.16464	0.09802
SUPERBATCH MEAN VALUES	0.02127	0.00365	0.97508	0.73396	0.16564	0.10040
STAND. DEV.	0.00026	0.00005	0.00021	0.00293	0.00088	0.00206

CMOGENEIZATION ACCORDING ISOTOPE *** U-236 ***

ELEMENTS ORDERED ACCORDING ENCREASING CONCENTRATION OF THE SELECTED ISOTOPE U-236

	FUEL ELEMENT IDENT.			U-235	U-236	U-238	PU-239	PU-240	PU 241
1	509-057	I05	115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875
2	509-053	E03	75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181
3	509-051	H10	55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
4	509-052	I07	117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
5	509-054	D08	86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
6	509-074	H04	109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
7	509-067	D06	84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
8	509-043	H08	113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
9	509-078	E09	107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
10	509-058	E05	88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
11	509-055	H06	111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
12	509-046	G05	103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
13	509-076	F04	94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
14	509-065	C07	82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800
15	509-059	I04	68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
16	509-073	J06	119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
17	509-061	J04	65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
18	509-045	E07	90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
19	509-050	E09	92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
20*	509-109	F10	100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789
21	509-075	F08	98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
22.	509-069.	D04..	78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204
23	509-048	C08	45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
24	509-071	G07	105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208
25	509-044	I09	58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
26	509-072	F06	96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
27	509-063	C05	80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
28	509-064	G10	108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
29	509-062	E10	50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
30	509-042	H03	70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
31	509-047	F03	93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473
32.	509-041	J08..	60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580
33*	509-116	J03	66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
34*	509-112	I03	69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001
35*	509-114	D03	76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
36*	509-118	C04	79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
37*	509-115	C09	46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
38*	509-113	I10	56	0.02095	0.00371	0.97534	0.73010	0.16688	0.10303
39*	509-111	D10	49	0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
40*	509-117	J09	59	0.02085	0.00373	0.97542	0.72890	0.16721	0.10389

LIST OF REJECTED ELEMENTS

	FUEL ELEMENT IDENT.			U-235	U-236	U-238	PU-239	PU-240	PU 241
1	509-044	I09	58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
2	509-072	F06	96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
3	509-063	C05	80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
4	509-064	G10	108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
5	509-062	E10	50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
6	509-042	H03	70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
7	509-047	F03	93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473

FIRST SUPERBATCH

	FUEL ELEMENT IDENT.			U-235	U-236	U-238	PU-239	PU-240	PU 241
26	509-057	I05	115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875
24	509-071	G07	105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208
16	509-073	J06	119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
BATCH 1				0.01497	0.00325	0.98178	0.70453	0.18893	0.10654
27	509-053	E03	75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181
14	509-048	C08	45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
10	509-059	I04	68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
BATCH 2				0.01489	0.00327	0.98185	0.70348	0.18923	0.10728
25	509-051	H10	55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
39.	509-069.D04..		78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204
35	509-065	C07	82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800
BATCH 3				0.01489	0.00326	0.98185	0.70329	0.18925	0.10746
8	509-052	I07	117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
23	509-075	F08	98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
4	509-076	F04	94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
BATCH 4				0.01487	0.00327	0.98186	0.70295	0.18944	0.10761
12	509-054	D08	86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
1*	509-109	F10	100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789
32	509-046	G05	103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
BATCH 5				0.01767	0.00327	0.97906	0.72133	0.17910	0.09956
6	509-074	H04	109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
19	509-050	E09	92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
20	509-055	H06	111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664

BATCH 6			0.01486	0.00327	0.98187	0.70296	0.18950	0.10755
28	509-067	D06 84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
34	509-045	E07 90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
5	509-058	E05 88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
BATCH 7			0.01486	0.00327	0.98187	0.70320	0.18921	0.10759
9	509-043	H08 113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
11	509-061	J04 65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
7	509-078	G09 107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
BATCH 8			0.01486	0.00327	0.98187	0.70264	0.18963	0.10773
SUPERBATCH	MEAN VALUES		0.01523	0.00327	0.98150	0.70555	0.18804	0.10642
	STAND. DEV.		0.00099	0.00001	0.00099	0.00640	0.00362	0.00279

SECOND SUPERBATCH

FUEL ELEMENT IDENT.			U-235	U-236	U-238	PU-239	PU-240	PU 241
40.	509-041	J08.. 60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580
3*	509-117	J09 59	0.02085	0.00373	0.97542	0.72890	0.16721	0.10389
37*	509-115	C09 46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
BATCH 1			0.01864	0.00361	0.97774	0.71731	0.17537	0.10732
29*	509-116	J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
2*	509-111	D10 49	0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
36*	509-118	C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
BATCH 2			0.02113	0.00368	0.97519	0.73247	0.16605	0.10149
30*	509-112	I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001
38*	509-113	I10 56	0.02095	0.00371	0.97534	0.73010	0.16688	0.10303
31*	509-114	D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
BATCH 3			0.02111	0.00368	0.97521	0.73208	0.16624	0.10168
SUPERBATCH	MEAN VALUES		0.02029	0.00366	0.97605	0.72728	0.16922	0.10350
	STAND. DEV.		0.00143	0.00004	0.00147	0.00864	0.00533	0.00331

CMCGENEIZATION ACCORDING ISOTOPE *** U-238 ***

ELEMENTS ORCERED ACCORDING ENCREASING CONCENTRATION OF THE SELECTED ISOTOPE U-238

	FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
1*	509-109 F10 100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789
2*	509-116 J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
3*	509-112 I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001
4*	509-114 D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
5*	509-118 C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
6*	509-115 C09 46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
7*	509-111 D10 49	0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
8*	509-113 I10 56	0.02095	0.00371	0.97534	0.73010	0.16688	0.10303
9*	509-117 J09 59	0.02085	0.00373	0.97542	0.72890	0.16721	0.10389
10	509-057 I05 115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875
11	509-053 E03 75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181
12	509-051 H10 55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
13	509-052 I07 117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
14	509-054 D08 86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
15	509-074 H04 109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
16	509-067 D06 84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
17	509-043 H08 113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
18	509-058 E05 88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
19	509-078 G09 107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
20	509-046 G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
21	509-055 H06 111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
22	509-076 F04 94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
23	509-065 C07 82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800
24	509-059 I04 68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
25	509-073 J06 119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
26	509-061 J04 65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
27	509-045 E07 90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
28	509-050 E09 92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
29	509-075 F08 98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
30.	509-069. D04.. 78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204
31	509-044 I09 58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
32	509-048 C08 45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
33	509-071 G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208
34	509-072 F06 96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
35	509-063 C05 80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
36	509-064 G10 108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
37	509-062 E10 50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
38	509-042 H03 70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
39	509-047 F03 93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473
40.	509-041 J08.. 60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580

LIST OF REJECTED ELEMENTS

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
1 509-073 J06 119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
2 509-061 J04 65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
3 509-045 E07 90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
4 509-050 F09 92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
5 509-075 F08 98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
6.509-069.D04.. 78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204
7 509-044 I09 58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255

FIRST SUPERBATCH

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
1*509-109 F10 100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789
10 509-059 I04 68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
28 509-067 D06 84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
BATCH 1	0.01756	0.00329	0.97915	0.71997	0.17947	0.10056
30*509-112 I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001
4 509-076 F04 94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
6 509-074 H04 109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
BATCH 2	0.01712	0.00338	0.97951	0.71470	0.18125	0.10405
29*509-116 J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
35 509-065 C07 82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800
12 509-054 D08 86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
BATCH 3	0.01715	0.00337	0.97948	0.71532	0.18091	0.10377
31*509-114 D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
20 509-055 H06 111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
8 509-052 I07 117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
BATCH 4	0.01711	0.00338	0.97951	0.71469	0.18110	0.10421
36*509-118 C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
32 509-046 G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
25 509-051 H10 55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
BATCH 5	0.01716	0.00337	0.97947	0.71537	0.18088	0.10375
37*509-115 C09 46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
7 509-078 G09 107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
27 509-053 E03 75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181

BATCH 6		0.01717	0.00337	0.97946	0.71565	0.18083	0.10351
38*509-113 I10 56		0.02095	0.00371	0.97534	0.73010	0.16688	0.10303
9 509-043 H08 113		0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
26 509-057 I05 115		0.01581	0.00310	0.98109	0.71566	0.18559	0.09875
BATCH 7		0.01726	0.00335	0.97939	0.71683	0.18045	0.10271
2*509-111 D10 49		0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
5 509-058 E05 88		0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
3*509-117 J09 59		0.02085	0.00373	0.97542	0.72890	0.16721	0.10389
BATCH 8		0.01893	0.00356	0.97751	0.72139	0.17413	0.10448
SUPERBATCH MEAN VALUES		0.01743	0.00338	0.97918	0.71674	0.17988	0.10338
STAND. DEV.		0.00062	0.00008	0.00069	0.00255	0.00239	0.00126

SECOND SUPERBATCH

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
21 509-072 F06 96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
33 509-042 H03 70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
22 509-062 E10 50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
BATCH 1	0.01425	0.00338	0.98237	0.69512	0.19162	0.11326
24 509-071 G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208
18 509-047 F03 93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473
15 509-064 G10 108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
BATCH 2	0.01424	0.00338	0.98238	0.69447	0.19201	0.11352
14 509-048 C08 45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
40.509-041 J08.. 60	0.01424	0.00342	0.98254	0.69162	0.19258	0.11580
17 509-063 C05 80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
BATCH 3	0.01423	0.00338	0.98238	0.69448	0.19183	0.11369
SUPERBATCH MEAN VALUES	0.01424	0.00338	0.98238	0.69469	0.19182	0.11349
STAND. DEV.	0.00001	0.00000	0.00001	0.00037	0.00020	0.00022

CMCGENEIZATION ACCORDING ISOTOPE *** PU-239 ***

ELEMENTS ORDERED ACCORDING ENCREASING CONCENTRATION OF THE SELECTED ISOTOPE PU-239

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
1.509-041 J08..60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580
2 509-047 F03 93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473
3 509-064 G10 108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
4 509-042 H03 70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
5 509-062 E10 50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
6 509-063 C05 80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
7 509-048 C08 45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
8 509-044 I09 58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
9 509-072 F06 96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
10 509-071 G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208
11.509-069.D04..78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204
12 509-075 F08 98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
13 509-050 E09 92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
14 509-061 J04 65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
15 509-045 E07 90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
16 509-073 J06 119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
17 509-065 C07 82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800
18 509-059 I04 68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
19 509-076 F04 94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
20 509-046 G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
21 509-078 G09 107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
22 509-055 H06 111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
23 509-043 H08 113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
24 509-058 E05 88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
25 509-067 D06 84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
26 509-074 H04 109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
27 509-054 D08 86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
28 509-052 I07 117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
29 509-051 H10 55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
30 509-053 E03 75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181
31 509-057 I05 115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875
32*509-117 J09 59	0.02085	0.00373	0.97542	0.72890	0.16721	0.10389
33*509-113 I10 56	0.02095	0.00371	0.97534	0.73010	0.16688	0.10303
34*509-111 D10 49	0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
35*509-118 C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
36*509-115 C09 46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
37*509-114 D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
38*509-112 I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001
39*509-116 J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
40*509-109 F10 100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789

LIST OF REJECTED ELEMENTS

	FUEL ELEMENT IDENT.			U-235	U-236	U-238	PU-239	PU-240	PU 241
1	509-067	D06	84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
2	509-074	H04	109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
3	509-054	D08	86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
4	509-052	I07	117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
5	509-051	H10	55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
6	509-053	E03	75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181
7	509-057	I05	115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875

FIRST SUPERBATCH

	FUEL ELEMENT IDENT.			U-235	U-236	U-238	PU-239	PU-240	PU 241
40	509-041	J08	60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580
5	509-058	E05	88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
16	509-073	J06	119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
BATCH 1				0.01460	0.00332	0.98208	0.69913	0.19049	0.11038
18	509-047	F03	93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473
9	509-043	H08	113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
34	509-045	E07	90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
BATCH 2				0.01457	0.00332	0.98211	0.69891	0.19065	0.11044
15	509-064	G10	108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
20	509-055	H06	111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
11	509-061	J04	65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
BATCH 3				0.01459	0.00332	0.98209	0.69908	0.19067	0.11025
33	509-042	H03	70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
7	509-078	G09	107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
19	509-050	E09	92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
BATCH 4				0.01455	0.00332	0.98212	0.69885	0.19070	0.11045
17	509-063	C05	80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
4	509-076	F04	94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
23	509-075	F08	98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
BATCH 5				0.01454	0.00333	0.98213	0.69875	0.19062	0.11063
13	509-044	I09	58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
35	509-065	C07	82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800
39	509-069	D04	78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204

BATCH 6		0.01452	0.00333	0.98215	0.69857	0.19057	0.11086
22	509-062 E10 50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
32	509-046 G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
24	509-071 G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208
BATCH 7		0.01452	0.00333	0.98215	0.69855	0.19061	0.11084
14	509-048 C08 45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
10	509-059 I04 68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
21	509-072 F06 96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
BATCH 8		0.01450	0.00333	0.98217	0.69858	0.19065	0.11078
SUPERBATCH	MEAN VALUES	0.01455	0.00333	0.98212	0.69880	0.19062	0.11058
	STAND. DEV.	0.00004	0.00001	0.00003	0.00023	0.00007	0.00023

SECOND SUPERBATCH

FUEL ELEMENT IDENT.		U-235	U-236	U-238	PU-239	PU-240	PU 241
2*509-111	D10 49	0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
30*509-112	I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10091
31*509-114	D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10282
BATCH 1		0.02111	0.00368	0.97521	0.73220	0.16612	0.10168
38*509-113	I10 56	0.02095	0.00371	0.97534	0.73010	0.16688	0.10303
29*509-116	J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
37*509-115	C09 46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
BATCH 2		0.02112	0.00368	0.97520	0.73235	0.16612	0.10153
3*509-117	J09 59	0.02085	0.00373	0.97542	0.72890	0.16721	0.10389
1*509-109	F10 100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789
36*509-118	C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
BATCH 3		0.02158	0.00359	0.97483	0.73734	0.16468	0.09798
SUPERBATCH	MEAN VALUES	0.02127	0.00365	0.97508	0.73396	0.16564	0.10040
	STAND. DEV.	0.00027	0.00005	0.00022	0.00293	0.00083	0.00209

CMOGENEIZATION ACCORDING ISOTOPE *** PU-240 ***

ELEMENTS ORDERED ACCORDING ENCREASING CONCENTRATION OF THE SELECTED ISOTOPE PU-240

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
1*509-109 F10 100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789
2*509-116 J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
3*509-112 I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001
4*509-115 C09 46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
5*509-114 D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
6*509-118 C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
7*509-111 D10 49	0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
8*509-113 I10 56	0.02095	0.00371	0.97534	0.73010	0.16688	0.10313
9*509-117 J09 59	0.02085	0.00373	0.97542	0.72895	0.16721	0.10389
10 509-057 I05 115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875
11 509-053 E03 75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181
12 509-051 H10 55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
13 509-054 D08 86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
14 509-052 I07 117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
15 509-058 E05 88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
16 509-074 H04 109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
17 509-067 D06 84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
18 509-043 H08 113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
19 509-055 H06 111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
20 509-046 G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
21 509-078 G09 107	0.01495	0.00325	0.98176	0.70424	0.18931	0.10645
22 509-059 I04 68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
23 509-076 F04 94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
24 509-065 C07 82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800
25 509-073 J06 119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
26 509-045 E07 90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
27 509-061 J04 65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
28 509-075 F08 98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
29 509-050 E09 92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
30. 509-069. D04.. 78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204
31 509-071 G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11218
32 509-044 I09 58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
33 509-072 F06 96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
34 509-063 C05 80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
35 509-048 C08 45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
36 509-062 E10 50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
37 509-042 H03 70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
38 509-064 G10 108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
39. 509-041 J08.. 60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580
40 509-047 F03 93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473

LIST OF REJECTED ELEMENTS

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
1 509-073 J06 119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
2 509-045 E07 90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
3 509-061 J04 65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
4 509-075 F08 98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
5 509-050 E09 92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
6.509-069.D04.. 78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204
7 509-071 G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208

FIRST SUPERBATCH

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
1*509-109 F10 100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789
35 509-065 C07 82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10800
6 509-074 H04 109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
BATCH 1	0.01759	0.00328	0.97912	0.72015	0.17958	0.10027
30*509-112 I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001
19 509-059 I04 68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
5 509-058 E05 88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
BATCH 2	0.01703	0.00339	0.97957	0.71408	0.18113	0.10479
29*509-116 J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
4 509-076 F04 94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
8 509-052 I07 117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
BATCH 3	0.01726	0.00336	0.97944	0.71560	0.18091	0.10349
2*509-111 D10 49	0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
9 509-043 H08 113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
12 509-054 D08 86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
BATCH 4	0.01707	0.00339	0.97955	0.71443	0.18108	0.10448
36*509-118 C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
20 509-055 H06 111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
25 509-051 H10 55	0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
BATCH 5	0.01716	0.00337	0.97947	0.71543	0.18085	0.10372
31*509-114 D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
32 509-046 G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
27 509-053 E03 75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181

BATCH 6		0.01718	0.00337	0.97945	0.71568	0.18080	0.10352
38*	509-113 I10 56	0.02095	0.00371	0.97534	0.73010	0.16688	0.10303
28	509-067 D06 84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
26	509-057 I05 115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875
BATCH 7		0.01727	0.00335	0.97938	0.71703	0.18039	0.10258
37*	509-115 C09 46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
7	509-078 G09 107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
3*	509-117 J09 59	0.02085	0.00373	0.97542	0.72890	0.16721	0.10389
BATCH 8		0.01896	0.00356	0.97748	0.72152	0.17428	0.10421
SUPERBATCH	MEAN VALUES	0.01743	0.00338	0.97918	0.71674	0.17988	0.10338
	STAND. DEV.	0.00064	0.00008	0.00070	0.00270	0.00232	0.00143

SECOND SUPERBATCH

FUEL ELEMENT IDENT.		U-235	U-236	U-238	PU-239	PU-240	PU 241
21	509-072 F06 96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
40.	509-041 J08.. 60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580
33	509-042 F03 70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
BATCH 1		0.01419	0.00339	0.98242	0.69415	0.19188	0.11397
17	509-063 C05 80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
15	509-064 G10 108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
22	509-062 E10 50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
BATCH 2		0.01425	0.00338	0.98237	0.69468	0.19183	0.11349
13	509-044 I09 58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
18	509-047 F03 93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473
14	509-048 C08 45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
BATCH 3		0.01428	0.00337	0.98234	0.69505	0.19178	0.11317
SUPERBATCH	MEAN VALUES	0.01424	0.00338	0.98238	0.69463	0.19183	0.11354
	STAND. DEV.	0.00004	0.00001	0.00004	0.00045	0.00005	0.00040

CMCGENEIZATION ACCCRDJNG ISOTOPE *** PU 241 ***

ELFMENTS CRCERED ACCORDING ENCREASING CONCENTRATION OF THE SELECTED ISOTCPE PU 241

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
1*509-109 F10 100	0.02282	0.00335	0.97383	0.75173	0.16638	0.08789
2 509-057 I05 115	0.01581	0.00319	0.98109	0.71566	0.18559	0.09875
3*509-116 J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
4*509-112 I03 69	0.02136	0.00364	0.97505	0.73458	0.16541	0.10001
5 509-053 E03 75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181
6*509-114 D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
7*509-118 C04 79	0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
8*509-115 C09 46	0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
9 509-051 H10 55	0.01545	0.00317	0.98138	0.71154	0.18712	0.10234
10*509-111 D10 49	0.02095	0.00371	0.97534	0.73145	0.16652	0.10303
11*509-113 I10 56	0.02095	0.00371	0.97534	0.73115	0.16688	0.10303
12*509-117 J09 59	0.02085	0.00373	0.97542	0.72899	0.16721	0.10389
13 509-052 I07 117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
14 509-054 D08 86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
15 509-074 H04 109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
16 509-067 D06 84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
17 509-043 H08 113	0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
18 509-078 G09 107	0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
19 509-058 E05 88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
20 509-055 H06 111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
21 509-046 G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
22 509-076 F04 94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
23 509-059 I04 68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
24 509-065 C07 82	0.01484	0.00327	0.98189	0.70239	0.18971	0.10800
25 509-073 J06 119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10882
26 509-045 E07 90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
27 509-061 J04 65	0.01456	0.00332	0.98211	0.69893	0.19076	0.11037
28 509-050 E09 92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
29 509-075 F08 98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
30*509-069 D04 78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204
31 509-071 G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208
32 509-048 C08 45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
33 509-072 F06 96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
34 509-044 I09 58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
35 509-063 C05 80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
36 509-062 E10 50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
37 509-064 G10 108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
38 509-042 H03 70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
39 509-047 F03 93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473
40.509-041 J08 60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11560

LIST OF REJECTED ELEMENTS

	FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
1	509-073 J06 119	0.01476	0.00329	0.98195	0.70096	0.19024	0.10880
2	509-045 E07 90	0.01454	0.00333	0.98213	0.69947	0.19029	0.11024
3	509-061 J04 65	0.01456	0.00332	0.98211	0.69893	0.19070	0.11037
4	509-050 E09 92	0.01447	0.00334	0.98219	0.69808	0.19083	0.11109
5	509-075 F08 98	0.01440	0.00335	0.98225	0.69760	0.19077	0.11163
6	509-069 D04 78	0.01437	0.00336	0.98227	0.69704	0.19091	0.11204
7	509-071 G07 105	0.01435	0.00336	0.98229	0.69695	0.19097	0.11208

FIRST SUPERBATCH

	FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
1*	509-109 F10 100	0.02282	0.00335	0.97383	0.75173	0.16038	0.08789
35	509-065 C07 82	0.01484	0.00327	0.98189	0.70230	0.18971	0.10850
28	509-067 D06 84	0.01506	0.00324	0.98170	0.70532	0.18870	0.10598
BATCH 1		0.01757	0.00329	0.97914	0.71978	0.17960	0.10062
29*	509-116 J03 66	0.02138	0.00363	0.97499	0.73555	0.16519	0.09927
4	509-076 F04 94	0.01492	0.00326	0.98182	0.70310	0.18968	0.10723
6	509-074 H04 109	0.01513	0.00322	0.98165	0.70644	0.18865	0.10491
BATCH 2		0.01714	0.00337	0.97948	0.71503	0.18117	0.10380
26	509-057 I05 115	0.01581	0.00310	0.98109	0.71566	0.18559	0.09875
10	509-059 I04 68	0.01481	0.00328	0.98191	0.70286	0.18933	0.10781
12	509-054 D08 86	0.01523	0.00321	0.98157	0.70811	0.18783	0.10406
BATCH 3		0.01528	0.00320	0.98152	0.70888	0.18758	0.10354
30*	509-112 I03 69	0.02130	0.00364	0.97505	0.73458	0.16541	0.10001
32	509-046 G05 103	0.01498	0.00325	0.98177	0.70416	0.18909	0.10675
8	509-052 I07 117	0.01530	0.00319	0.98151	0.70816	0.18787	0.10397
BATCH 4		0.01719	0.00336	0.97944	0.71563	0.18079	0.10357
27	509-053 E03 75	0.01550	0.00316	0.98135	0.71131	0.18688	0.10181
25	509-055 H06 111	0.01498	0.00325	0.98177	0.70435	0.18901	0.10664
3*	509-117 J09 59	0.02085	0.00373	0.97542	0.72890	0.16721	0.10389
BATCH 5		0.01711	0.00338	0.97951	0.71485	0.18104	0.10411
31*	509-114 D03 76	0.02107	0.00369	0.97525	0.73156	0.16642	0.10202
5	509-058 E05 88	0.01499	0.00325	0.98176	0.70481	0.18865	0.10654
38*	509-113 I10 56	0.02095	0.00371	0.97534	0.73010	0.16688	0.10303

BATCH 6		0.01900	0.00355	0.97745	0.72216	0.17398	0.10386
36*509-118 C04 79		0.02105	0.00369	0.97525	0.73140	0.16644	0.10216
7 509-078 G09 107		0.01499	0.00325	0.98176	0.70424	0.18931	0.10645
2*509-111 D10 49		0.02095	0.00371	0.97534	0.73045	0.16652	0.10303
BATCH 7		0.01900	0.00355	0.97745	0.72203	0.17409	0.10388
37*509-115 C09 46		0.02103	0.00369	0.97527	0.73140	0.16631	0.10228
9 509-043 H08 113		0.01503	0.00324	0.98173	0.70474	0.18890	0.10636
25 509-051 H10 55		0.01545	0.00317	0.98138	0.71054	0.18712	0.10234
BATCH 8		0.01717	0.00337	0.97946	0.71556	0.18078	0.10366
SUPERBATCH MEAN VALUES		0.01743	0.00338	0.97918	0.71674	0.17988	0.10338
STAND. DEV.		0.00119	0.00012	0.00130	0.00443	0.00435	0.00113

SECOND SUPERBATCH

FUEL ELEMENT IDENT.	U-235	U-236	U-238	PU-239	PU-240	PU 241
13 509-044 I09 58	0.01436	0.00336	0.98228	0.69637	0.19108	0.11255
33 509-042 H03 70	0.01421	0.00339	0.98241	0.69424	0.19195	0.11381
15 509-064 G10 108	0.01423	0.00338	0.98239	0.69395	0.19231	0.11374
BATCH 1	0.01427	0.00338	0.98236	0.69485	0.19178	0.11337
21 509-072 F06 96	0.01434	0.00336	0.98230	0.69660	0.19112	0.11228
18 509-047 F03 93	0.01414	0.00340	0.98247	0.69251	0.19276	0.11473
22 509-062 E10 50	0.01422	0.00338	0.98240	0.69453	0.19178	0.11368
BATCH 2	0.01423	0.00338	0.98239	0.69455	0.19189	0.11357
14 509-048 C08 45	0.01435	0.00336	0.98229	0.69628	0.19149	0.11223
40.509-041 J08.. 60	0.01404	0.00342	0.98254	0.69162	0.19258	0.11580
17 509-063 C05 80	0.01431	0.00337	0.98232	0.69555	0.19141	0.11304
BATCH 3	0.01423	0.00338	0.98238	0.69448	0.19183	0.11369
SUPERBATCH MEAN VALUES	0.01424	0.00338	0.98238	0.69463	0.19183	0.11354
STAND. DEV.	0.00002	0.00000	0.00002	0.00020	0.00005	0.00016

```
C
C
C     COMPUTER CODE CC2
C
C
      REAL*4 M,MM
      DIMENSION SCRITT(20)
      DIMENSION M(50),SM(50),X(50),SX(50)
      DIMENSION EM(50),EX(50),HH(50),EQ(50)
      DIMENSION XX(2,50),T(2,50),P(2,50)
      DIMENSION XC(3),        NB(3),EXJ(3)
      DIMENSION LD(62)
      DIMENSION CL(20),QL(20)
      DIMENSION NUM(62)
      DIMENSION ANUM(62),Q(62)
      DIMENSION PDF(62)
      DIMENSION K7(50)
C
  101 FORMAT (5I10)
  102 FORMAT (5F10.0)
  103 FORMAT (4F10.4)
  104 FORMAT (3F10.0)
  110 FORMAT (20A4)
C
  200 FORMAT (1H1)
  201 FORMAT (///' INITIAL NUMBER FOR SUBROUTINE ''GAUSS'' ',I5,//,
     1' INITIAL NUMBER FOR SUBROUTINE ''RANDOM'' (SETRAND)',F6.0)
  202 FORMAT (/,' NUMEROSITY OF THE SAMPLE FOR STATISTICAL ANALYSIS',I7)
  203 FORMAT (1H1,'  **  STATISTICAL ANALYSIS RESULTS **',///,
     1' MEAN VALUE              ',F10.4,/,
     2' STANDARD DEVIATION      ',F10.4,/,
     3' PERCENT ST. DEV.        ',F10.4,/,
     4' MEDIAN VALUE            ',F10.4)
  205 FORMAT (1H ,I3,4F10.4)
  208 FORMAT (1H ,I6,I10,F20.4)
  209 FORMAT (/,1H ,8X,'TOTAL =',F9.2,////)
  210 FORMAT (1H ,2F20.4)
  211 FORMAT (1H ,10F12.4)
  212 FORMAT (1H ,I4,3F15.4)
  222 FORMAT (1H ,'      MASS      PDF',/)
  223 FORMAT (1H ,'      MASS    DISTR.',/)
  224 FORMAT (1H ,10X,6F10.4,2F15.4)
  225 FORMAT (1H ,F10.2,F6.3)
  226  FORMAT (1H1' PROCESS INVENTORY DISTRIBUTION,STEP=',F5.0,//)
  227 FORMAT (1H ,10I6)
  228 FORMAT (1H ,F10.2,F6.3,2X,100A1)
  230 FORMAT (1H ,20A4)
  231 FORMAT (1H )
```

```
0037          232 FORMAT (/)
0038          233 FORMAT (1H ,8X,'H(',I2,') =',F9.2)
0039          234 FORMAT(///)
0040          235 FORMAT (/////,' PART OF THE INVENTORY CONTAINED IN EACH OUTPUT BATCH'
                1CH',/)
0041          236 FORMAT (////,'  CONFIDENCE INTERVALS',///,
                1'          P(X)      X-MEAN                X',//)
0042          237 FORMAT (I5,F8.1,2F12.2)
0043          238 FORMAT (///,' FOR INCOMPATIBILITY AMONG PROGRAM DIMENSIONS,QMS AND
                1 DM, THE VALUE OF QMS HAS BEEN REDUCED TO',F6.2,///)
              C
0044          301 FORMAT (5I10)
0045          302 FORMAT (5F12.7)
0046          303 FORMAT (5F10.2)
              C
              C             ******      ******      ******      ******      ******
              C
0047                REAL STAR/'*'/
0048                DIMENSION STARS(100)
0049                DO 501 J=1,100
0050                STARS(J)=STAR
0051          501 CONTINUE
              C
0052                WRITE (6,200)
0053                READ (5,110) SCRITT
0054                WRITE (6,230) SCRITT
0055                WRITE (6,234)
              C
0056                DO 5 J=1,2
0057                READ (5,110) SCRITT
0058                WRITE (6,230) SCRITT
0059                WRITE (6,232)
0060                READ (5,110) SCRITT
0061                WRITE (6,230) SCRITT
0062                WRITE (6,231)
0063                READ (5,101) NB(J)
0064                NBB=NB(J)
0065                DO 1 K=1,NBB
0066                READ (5,104) T(J,K),XX(J,K)
0067            1 CONTINUE
0068                A1=0.
0069                A3=0.
0070                NBB=NB(J)
0071                DO 2 K=1,NBB
0072                A1=A1+T(J,K)*XX(J,K)
0073                A3=A3+T(J,K)
0074            2 CONTINUE
0075                DO 4 K=1,NBB
```

```
0076              P(J,K)=T(J,K)/A3
0077            4 CONTINUE
0078              XC(J)=A1/A3
0079              WRITE (6,212) ((K,T(J,K),XX(J,K),      P(J,K)),K=1,NBB)
0080              WRITE (6,232)
0081              READ (5,110) SCRITT
0082              WRITE (6,230) SCRITT
0083              WRITE (6,231)
0084              WRITE (6,208) (J,NB(J),XC(J))
0085              WRITE (6,234)
0086            5 CONTINUE
0087              C1=XC(1)
0088              C2=XC(2)
                C
0089              WRITE (6,200)
0090              READ (5,110) SCRITT
0091              WRITE (6,230) SCRITT
0092              WRITE (6,234)
0093              READ (5,101) NBATCH
0094              READ (5,110) SCRITT
0095              WRITE (6,230) SCRITT
0096              WRITE (6,231)
0097              READ (5,103) ((M(J),SM(J),X(J),SX(J)            ),J=1,NBATCH)
0098              DO 9 J=1,NBATCH
0099              WRITE (6,205)  (J,M(J),SM(J),X(J),SX(J))
0100            9 CONTINUE
                C
0101              MM=0.
0102              DC=C1-C2
0103              DO 14 K=1,NBATCH
0104              HH(K)=M(K)*(X(K)-C2)/DC
0105              MM=MM+HH(K)
0106           14 CONTINUE
0107              WRITE (6,235)
0108              WRITE (6,233) ((K,HH(K)),K=1,NBATCH)
0109              WRITE (6,209) MM
                C
                C              ******      ******      ******      ******
                C
0110              WRITE (6,200)
0111              READ (5,110) SCRITT
0112              WRITE (6,230) SCRITT
0113              READ (5,101) IX
0114              READ (5,103) RNO
0115              CALL SETRND(RNC)
0116              READ (5,101) NPROVE
0117              PROVE=NPROVE
0118              READ (5,103) QMS,DM
```

```
0119                WRITE (6,201) IX,RNO
0120                WRITE (6,202) NPROVE
0121                C=100./FLOAT(NPROVE)
0122                READ (5,101) NCL
0123                READ (5,102) (CL(J),J=1,NCL)
0124                READ (5,101) IPUNCH
                C
0125                DO 71 LG=1,62
0126             71 LD(LG)=0.
0127                Q1=0.
0128                Q2=0.
                C
0129                LX=INT(QMS/DM)
0130                IF(LX.LT.30) GO TO 50
0131                QMS=30*DM
0132                LMX=62
0133                WRITE (6,238) QMS
0134                GO TO 52
0135             50 CONTINUE
0136                AMM=MM-QMS
0137                IF(AMOD(QMS,DM).LT.(DM*0.01)) GO TO 51
0138                LX=LX+1
0139                QMS=LX*DM
0140             51 CONTINUE
0141                LMX=2*LX+2
0142             52 CONTINUE
                C
0143                Q(1)=MM-DM*(FLOAT(LX)+0.5)
0144                DO 55 J=2,LMX
0145                Q(J)=Q(1)+(J-1)*DM
0146             55 CONTINUE
                C
0147                DO 13 L=1,NPROVE
0148                DO 31 J=1,2
0149                A1=0.
0150                A3=0.
0151                NBB=NB(J)
0152                DO 32 K=1,NBB
0153                A4=RANDOM(0.)*T(J,K)
0154                A1=A1+XX(J,K)*A4
0155                A3=A3+A4
0156             32 CONTINUE
0157                EXJ(J)=A1/A3
0158             31 CONTINUE
0159                EC1=EXJ(1)
0160                EC2=EXJ(2)
0161                DD=EC1-EC2
0162                DO 11 K=1,NBATCH
```

```
0163          417 CALL GAUSS(IX,SM(K),M(K),EM(K))
0164          418 CALL GAUSS(IX,SX(K),X(K),EX(K))
0165           11 CONTINUE
0166              EQQ=0.
0167              DO 12 K=1,NBATCH
0168              EQQ=EQQ+EM(K)*(EX(K)-EC2)/DD
0169           12 CONTINUE
                C
0170              Q1=Q1+EQQ
0171              Q2=Q2+EQQ*EQQ
0172              LG=(EQQ-AMM)/DM+2
0173              IF (LG.LT.1) LG=1
0174              IF (LG.GT.LMX) LG=LMX
0175              LD(LG)=LD(LG)+1
0176           13 CONTINUE
                C
0177              VMED=Q1/NPROVE
0178              VAR=Q2/NPROVE-VMED*VMED
0179              SDEV=SQRT(VAR)
0180              PERC=(SDEV/VMED)*100.
0181              WRITE (6,226) DM
0182              LMX1=LMX-1
0183              WRITE (6,227) (LD(LG),LG=1,LMX)
0184              I=LD(1)
0185              DO 15 J=2,LMX
0186              K=LD(J)
0187              I=MAX0(I,K)
0188           15 CONTINUE
0189              DO 16 J=2,LMX1
0190              K7(J)=LD(J)*50/I
0191           16 CONTINUE
                C
0192              DO 520 J=1,LMX
0193              PDF(J)=FLOAT(LD(J))/PROVE
0194          520 CONTINUE
0195              IF (IPUNCH.NE.777) GO TO 521
0196              IN=1
0197              DO 60 J=1,LMX
0198              IF (PDF(J).NE.0.) GO TO 61
0199              IN=IN+1
0200           60 CONTINUE
0201           61 CONTINUE
0202              IL=LMX
0203              DO 62 J=1,LMX
0204              K=LMX-J+1
0205              IF (PDF(K).NE.0.) GO TO 63
0206              IL=IL-1
0207           62 CONTINUE
```

```
0208            63 CONTINUE
0209               LU=IL-IN+1
0210               WRITE (7,301) LU
0211               WRITE (7,303) (Q(IN),VMED,SDEV)
0212               WRITE (7,302) (PDF(J),J=IN,IL)
0213           521 CONTINUE
               C
0214               WRITE (6,234)
0215               WRITE (6,222)
0216               DO 500 JJ=2,LMX1
0217               LLL=K7(JJ)
0218               IF (LLL.LE.0) GO TO 499
0219               WRITE (6,228) Q(JJ),PDF(JJ),(STARS(J),J=1,LLL))
0220               GO TO 500
0221           499 CONTINUE
0222               WRITE (6,225) (Q(JJ),PDF(JJ))
0223           500 CONTINUE
               C
0224               I=1
0225               CCC=CL(I)
0226               NUM(1)=LD(1)
0227               ANUM(1)= NUM(1)*C
0228               DO 513 J=2,LMX
0229               J1=J-1
0230               NUM(J)=NUM(J1)+LD(J)
0231               ANUM(J)=NUM(J)*C
0232               IF (I.GT.NCL) GO TO 57
0233               IF(ANUM(J).LT.CCC) GO TO 57
0234               QL(I)=Q(J)-DM*(ANUM(J)-CCC)/(ANUM(J)-ANUM(J-1))
0235               I=I+1
0236               CCC=CL(I)
0237            57 CONTINUE
0238           513 CONTINUE
               C
0239               WRITE (6,200)
0240               WRITE (6,227) (NUM(J),J=1,LMX)
0241               WRITE (6,234)
               C
0242               WRITE (6,223)
0243               DO 511 J=2,LMX
0244               PDF(J)=PDF(J-1)+PDF(J)
0245           511 CONTINUE
               C
0246               UM=NUM(LMX)
0247               F=100./UM
0248               DO 514  LG=1,LMX
0249               LD(LG)=NUM(LG)*F
0250           514 CONTINUE
```

```
0251              DO 515 JJ=1,LMX
0252              LLL=LD(JJ)
0253              IF (LLL.LE.0) GO TO 516
0254              WRITE (6,228) (Q(JJ),PDF(JJ),(STARS(J),J=1,LLL))
0255              GO TO 515
0256          516 CONTINUE
0257              WRITE (6,225) (Q(JJ),PDF(JJ))
0258          515 CONTINUE
0259              WRITE (6,203) VMED,SDEV,PERC,MM
0260              WRITE (6,236)
0261              DO 59 J=1,NCL
0262              QD=QL(J)-VMED
0263              WRITE (6,237) (J,CL(J),QD,QL(J))
0264           59 CONTINUE
0265              STOP
0266              END
```



```
0001              SUBROUTINE SETRND (JARG)
                  C
                  CC    INITIALIZE RANDOM SERIES
                  C
0002              INTEGER IARG/221/
0003              IF(JARG.NE.0) IARG=JARG
0004              IF (MOD(IARG,2).EQ.0) IARG=IARG+1
0005              RETURN
                  C
0006              ENTRY RANDOM (DUM)
                  C
                  CC    PRODUCE A RANDOM NUMBER UNIFORMALY DISTRIBUTE BETWEEN
                  CC    1 AND 0
                  C
0007              IARG=IARG*65539
0008              IF (IARG) 5,6,6
0009            5 IARG=IARG+2147483647+1
0010            6 RANDOM=IARG*0.4656613E-9
0011              RETURN
                  C
0012              ENTRY STLAST (LAST)
                  C
                  CC    STORE IN  'LAST'  THE LAST VALUE OF  IARG.
                  C
0013              LAST=IARG
0014              RETURN
0015              END
```

```
C                                                                       GAUSS001
C     ******************************************************************GAUSS002
C                                                                       GAUSS003
C        SUBROUTINE GAUSS                                               GAUSS004
C                                                                       GAUSS005
C        PURPOSE                                                        GAUSS006
C           COMPUTES A NORMALLY DISTRIBUTED RANDOM NUMBER WITH A GIVEN  GAUSS007
C           MEAN AND STANDARD DEVIATION                                 GAUSS008
C                                                                       GAUSS009
C        USAGE                                                          GAUSS010
C           CALL GAUSS(IX,S,AM,V)                                       GAUSS011
C                                                                       GAUSS012
C        DESCRIPTION OF PARAMETERS                                      GAUSS013
C           IX -IX MUST CONTAIN AN ODD INTEGER NUMBER WITH NINE OR      GAUSS014
C               LESS DIGITS ON THE FIRST ENTRY TO GAUSS. THEREAFTER     GAUSS015
C               IT WILL CONTAIN A UNIFORMLY DISTRIBUTED INTEGER RANDOM  GAUSS016
C               NUMBER GENERATED BY THE SUBROUTINE FOR USE ON THE NEXT  GAUSS017
C               ENTRY TO THE SUBROUTINE.                                GAUSS018
C           S  -THE DESIRED STANDARD DEVIATION OF THE NORMAL            GAUSS019
C               DISTRIBUTION.                                           GAUSS020
C           AM -THE DESIRED MEAN OF THE NORMAL DISTRIBUTION             GAUSS021
C           V  -THE VALUE OF THE COMPUTED NORMAL RANDOM VARIABLE        GAUSS022
C                                                                       GAUSS023
C        REMARKS                                                        GAUSS024
C           THIS SUBROUTINE USES RANDU WHICH IS MACHINE SPECIFIC        GAUSS025
C                                                                       GAUSS026
C        SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED                  GAUSS027
C           RANDU                                                       GAUSS028
C                                                                       GAUSS029
C        METHOD                                                         GAUSS030
C           USES 12 UNIFORM RANDOM NUMBERS TO COMPUTE NORMAL RANDOM     GAUSS031
C           NUMBERS BY CENTRAL LIMIT THEOREM. THE RESULT IS THEN        GAUSS032
C           ADJUSTED TO MATCH THE GIVEN MEAN AND STANDARD DEVIATION.    GAUSS033
C           THE UNIFORM RANDOM NUMBERS COMPUTED WITHIN THE SUBROUTINE   GAUSS034
C           ARE FOUND BY THE POWER RESIDUE METHOD.                      GAUSS035
C                                                                       GAUSS036
C     ******************************************************************GAUSS037
0001        SUBROUTINE GAUSS(IX,S,AM,V)                                 GAUSS038
0002        A=0.0                                                       GAUSS039
0003        DO 50 I=1,12                                                GAUSS040
0004        CALL RANDU(IX,IY,Y)                                         GAUSS041
0005        IX=IY                                                       GAUSS042
0006     50 A=A+Y                                                       GAUSS043
0007        V=(A-6.0)*S+AM                                              GAUSS044
0008        RETURN                                                      GAUSS045
0009        END                                                         GAUSS046
                                                                        GAUSS047
```

```
C                                                                       RANDU001
C     ******************************************************************RANDU002
C                                                                       RANDU003
C        SUBROUTINE RANDU                                               RANDU004
C                                                                       RANDU005
C        PURPOSE                                                        RANDU006
C           COMPUTES UNIFORMLY DISTRIBUTED RANDOM REAL NUMBERS BETWEEN  RANDU007
C           0 AND 1.0 AND RANDOM INTEGERS BETWEEN ZERO AND              RANDU008
C           2**31. EACH ENTRY USES AS INPUT AN INTEGER RANDOM NUMBER    RANDU009
C           AND PRODUCES A NEW INTEGER AND REAL RANDOM NUMBER.          RANDU010
C                                                                       RANDU011
C        USAGE                                                          RANDU012
C           CALL RANDU(IX,IY,YFL)                                       RANDU013
C                                                                       RANDU014
C        DESCRIPTION OF PARAMETERS                                      RANDU015
C           IX - FOR THE FIRST ENTRY THIS MUST CONTAIN ANY ODD INTEGER  RANDU016
C                NUMBER WITH NINE OR LESS DIGITS. AFTER THE FIRST ENTRY,RANDU017
C                IX SHOULD BE THE PREVIOUS VALUE OF IY COMPUTED BY THIS RANDU018
C                SUBROUTINE.                                            RANDU019
C           IY - A RESULTANT INTEGER RANDOM NUMBER REQUIRED FOR THE NEXTRANDU020
C                ENTRY TO THIS SUBROUTINE. THE RANGE OF THIS NUMBER IS  RANDU021
C                BETWEEN ZERO AND 2**31                                 RANDU022
C           YFL- THE RESULTANT UNIFORMLY DISTRIBUTED, FLOATING POINT,   RANDU023
C                RANDOM NUMBER IN THE RANGE 0 TO 1.0                    RANDU024
C                                                                       RANDU025
C        REMARKS                                                        RANDU026
C           THIS SUBROUTINE IS SPECIFIC TO SYSTEM/360                   RANDU027
C           THIS SUBROUTINE WILL PRODUCE 2**29 TERMS                    RANDU028
C           BEFORE REPEATING                                            RANDU029
C                                                                       RANDU030
C        SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED                  RANDU031
C           NONE                                                        RANDU032
C                                                                       RANDU033
C        METHOD                                                         RANDU034
C           POWER RESIDUE METHOD DISCUSSED IN IBM MANUAL C20-8011,      RANDU035
C           RANDOM NUMBER GENERATION AND TESTING                        RANDU036
C                                                                       RANDU037
C     ******************************************************************RANDU038
C                                                                       RANDU039
0001        SUBROUTINE RANDU(IX,IY,YFL)                                 RANDU040
0002        IY=IX*65539                                                 RANDU041
0003        IF(IY)5,6,6                                                 RANDU042
0004      5 IY=IY+2147483647+1                                          RANDU043
0005      6 YFL=IY                                                      RANDU044
0006        YFL=YFL*.4656613E-9                                         RANDU045
0007        RETURN                                                      RANDU046
0008        END
```

```
***  LIST OF THE DATA CARDS USED FOR THE "CC2" SAMPLE PROGRAM
***

 **  INPUT BATCH DATA **
 REACTOR CANDU
BATCH  TOTAL PU (G)     PU-241 PERC  WEIGHT FACTOR
       4
3434.4    3.41
3218.4    3.67
3301.0    3.61
3386.7    3.72
REACTOR  BATCH NUMB.    MEAN PERC.T CONCENT.N
 REACTOR VAK
BATCH  TOTAL PU (G)     PU-241 PERC  WEIGHT FACTOR
       4
3103.5    7.53
2109.6    8.00
4309.0    6.10
 702.7    7.74
REACTOR  BATCH NUMB.    MEAN PERC.T CONCENT.N
 **  OUTPUT BATCH DATA **
       4
 N   MASS        MASS-SD   PU/241    PU/241-SD
2881.1      14.4055    5.596     0.027980
2350.7      11.7535    6.515     0.032595
2657.0      13.2850    7.472     0.037360
3706.0      18.5300    7.667     0.038335
 **  STATISTICAL ANALYSIS INPUT DATA  **
     375
 375.
   10000                                                    APPROVE
  120.      50.
        6
    2.5        5.0       10.        20.        80.
   90.        95.       97.5
     000                                          WITHOUT PUNCHED CARDS
```

** INPUT BATCH DATA **

REACTOR CANDU

BATCH	TOTAL PU (G)	PU-241 PERC	WEIGHT FACTOR
1	3434.3999	3.4100	0.2559
2	3218.3999	3.6700	0.2398
3	3381.0000	3.8100	0.2519
4	3386.7000	3.7200	0.2524

REACTOR	BATCH NUMB.	MEAN PERC.T CONCENT.N
1	4	3.6514

REACTOR VAK

BATCH	TOTAL PU (G)	PU-241 PERC	WEIGHT FACTOR
1	3103.5000	7.5300	0.3035
2	2109.5999	8.0800	0.2063
3	4309.0000	8.1800	0.4214
4	702.7000	7.7400	0.0687

REACTOR	BATCH NUMB.	MEAN PERC.T CONCENT.N
2	4	7.9318

** OUTPUT BATCH DATA **

N	MASS	MASS-SD	PU/241	PU/241-SD
1	2881.0999	14.4055	5.5960	0.0280
2	2350.7000	11.7535	6.5190	0.0326
3	2657.0000	13.2850	7.4720	0.0374
4	3786.0000	18.9300	7.6670	0.0383

PART OF THE INVENTORY CONTAINED IN EACH OUTPUT BATCH

H(1) = 1572.20
H(2) = 775.88
H(3) = 285.43
H(4) = 234.24

TOTAL = 2867.75

** STATISTICAL ANALYSIS INPUT DATA **

INITIAL NUMBER FOR SUBROUTINE 'GAUSS' 375
INITIAL NUMBER FOR SUBROUTINE 'RANDOM' (SETRAND) 375.
NUMEROSITY OF THE SAMPLE FOR STATISTICAL ANALYSIS 10000

PROCESS INVENTORY DISTRIBUTION,STEP= 50.

0	0	0	0	0	0	1	3	2	11
21	35	56	68	94	121	183	248	321	365
487	569	641	797	883	926	858	787	708	627
491	340	227	92	29	4	1	0	0	0
0	0	0	0	0	0	0	0	0	0

MASS	PDF	
1692.75	0.0	
1742.75	0.0	
1792.75	0.0	
1842.75	0.0	
1892.75	0.0	
1942.75	0.0000	
1992.75	0.0000	
2042.75	0.0000	
2092.75	0.0001	
2142.75	0.0002	*
2192.75	0.0003	*
2242.75	0.0006	***
2292.75	0.0007	***
2342.75	0.0009	*****
2392.75	0.0012	******
2442.75	0.0018	*********
2492.75	0.0025	**********
2542.75	0.0032	**********
2592.75	0.0037	**********
2642.75	0.0049	**********
2692.75	0.0057	**********
2742.75	0.0064	**********
2792.75	0.0080	**********
2842.75	0.0088	**********
2892.75	0.0093	**********
2942.75	0.0086	**********
2992.75	0.0079	**********
3042.75	0.0071	**********
3092.75	0.0063	**********
3142.75	0.0049	**********
3192.75	0.0034	**********
3242.75	0.0023	**********
3292.75	0.0009	****
3342.75	0.0003	*
3392.75	0.0000	
3442.75	0.0000	
3492.75	0.0	
3542.75	0.0	
3592.75	0.0	
3642.75	0.0	
3692.75	0.0	
3742.75	0.0	
3792.75	0.0	
3842.75	0.0	
3892.75	0.0	
3942.75	0.0	
3992.75	0.0	

4842075 CoC

0	0	0	0	0	0	1	4	6	17
38	73	129	197	291	412	595	843	1164	1533
2020	2589	3230	4027	4910	5836	6694	7481	8189	8816
9307	9647	9874	9966	9995	9999	10000	10000	10000	10000
10000	10000	10000	10000	10000	10000	10000	10000	10000	10000

```
  MASS    DISTR.
1642.75 0.0
1692.75 0.0
1742.75 0.0
1792.75 0.0
1842.75 0.0
1892.75 0.0
1942.75 0.000
1992.75 0.000
2042.75 0.001
2092.75 0.002
2142.75 0.004
2192.75 0.007
2242.75 0.013  *
2292.75 0.020  *
2342.75 0.029  **
2392.75 0.041  ****
2442.75 0.059  *****
2492.75 0.084  ********
2542.75 0.116  ***********
2592.75 0.153  ***************
2642.75 0.202  ********************
2692.75 0.259  *************************
2742.75 0.323  ********************************
2792.75 0.403  ****************************************
2842.75 0.491  ************************************************
2892.75 0.584  ***********************************************************
2942.75 0.669  ****************************************************************
2992.75 0.748  ********************************************************************
3042.75 0.819  ************************************************************************
3092.75 0.882  ****************************************************************************
3142.75 0.931  ******************************************************************************
3192.75 0.965  ********************************************************************************
3242.75 0.987  **********************************************************************************
3292.75 0.997  ************************************************************************************
3342.75 0.999  ************************************************************************************
3392.75 1.000  ************************************************************************************
3442.75 1.000  ************************************************************************************
3492.75 1.000  ************************************************************************************
3542.75 1.000  ************************************************************************************
3592.75 1.000  ************************************************************************************
3642.75 1.000  ************************************************************************************
3692.75 1.000  ************************************************************************************
3742.75 1.000  ************************************************************************************
3792.75 1.000  ************************************************************************************
3842.75 1.000  ************************************************************************************
3892.75 1.000  ************************************************************************************
3942.75 1.000  ************************************************************************************
3992.75 1.000  ************************************************************************************
4042.75 1.000  ************************************************************************************
```

4092.75 1.000 **********

** STATISTICAL ANALYSIS RESULTS **

MEAN VALUE	2849.8687
STANDARD DEVIATION	255.9492
PERCENT ST. DEV.	8.9811
MEDIAN VALUE	2867.7485

CONFIDENCE INTERVALS

	P(X)	X-MEAN	X
1	2.5	-528.93	2320.94
2	5.0	-433.08	2416.79
3	10.0	-332.67	2517.20
4	20.0	-209.17	2640.70
5	80.0	179.53	3029.40
6	90.0	261.62	3111.49
7	95.0	321.26	3171.13
8	97.5	365.57	3215.44

```
                C
                C
                C      COMPUTER CODE CC3
                C
                C
0001                   REAL*4 M,MM
0002                   DIMENSION SCRITT(20)
0003                   DIMENSION M(10),SM(10),X(10),SX(10),Y(10),SY(10)
0004                   DIMENSION EM(10),EX(10),EY(10),EQ(10)
0005                   DIMENSION XX(3,5),YY(3,5),T(3,5),P(3,5),R(3,5)
0006                   DIMENSION XC(3),YC(3),NB(3),EXJ(3),EYJ(3)
0007                   DIMENSION LD(62)
0008                   DIMENSION CL(20),QL(20)
0009                   DIMENSION NUM(62)
0010                   DIMENSION ANUM(62),Q(62)
0011                   DIMENSION PDF(62)
0012                   DIMENSION K7(50)
0013                   DIMENSION BM(10)
                C
0014               101 FORMAT (5I10)
0015               102 FORMAT (5F10.0)
0016               103 FORMAT (6F10.4)
0017               104 FORMAT (3F10.0)
0018               110 FORMAT (20A4)
                C
0019               200 FORMAT (1H1)
0020               201 FORMAT (///' INITIAL NUMBER FOR SUBROUTINE ''GAUSS'' ',I5,//,
                      1' INITIAL NUMBER FOR SUBROUTINE ''RANDOM'' (SETRAND)',F6.0)
0021               202 FORMAT (/,' NUMEROSITY OF THE SAMPLE FOR STATISTICAL ANALYSIS',I7)
0022               203 FORMAT (//////,1H ,'  **  STATISTICAL ANALYSIS RESULTS **',///,
                      1' MEAN VALUE              ',F10.4,/,
                      2' STANDARD DEVIATION      ',F10.4,/,
                      3' PERCENT ST. DEV.        ',F10.4,/,
                      4' MEDIAN VALUE            ',F10.4)
0023               205 FORMAT (1H ,I3,6F10.4)
0024               208 FORMAT (1H ,I7,I8,2F15.4)
0025               209 FORMAT (/,1H ,8X,'TOTAL =',F9.2,////)
0026               212 FORMAT (1H ,I4,3F15.4)
0027               222 FORMAT (1H ,'     MASS    PDF',/)
0028               223 FORMAT (1H ,'     MASS   DISTR.',/)
0029               225 FORMAT (1H ,F10.2,F6.3)
0030               226  FORMAT (1H1'  PROCESS INVENTORY DISTRIBUTION,STEP=',F5.0,//)
0031               227 FORMAT (1H ,10I6)
0032               228 FORMAT (1H ,F10.2,F6.3,2X,100A1)
0033               230 FORMAT (1H ,20A4)
0034               231 FORMAT (1H )
0035               232 FORMAT (/)
0036               233 FORMAT (1H ,8X,'H(',I2,') =',F9.2)
```

```
0037          235 FORMAT (/////,' PART OF THE INVENTORY CONTAINED IN EACH OUTPUT BATCH'
                1CH',/)
0038          236 FORMAT (////,'  CONFIDENCE INTERVALS',///,
                1'          P(X)          X-MEAN                X',//)
0039          237 FORMAT (I5,F8.1,2F12.2)
0040          238 FORMAT (///,' FOR INCOMPATIBILITY AMONG PROGRAM DIMENSIONS,QMS AND
                1 DM, THE VALUE OF QMS HAS BEEN REDUCED TO',F8.2,///)
0041          264 FORMAT (///)
              C
0042          301 FORMAT (5I10)
0043          302 FORMAT (5F12.7)
0044          303 FORMAT (5F10.2)
              C
              C
0045               REAL STAR/'*'/
0046               DIMENSION STARS(100)
0047               DO 501 J=1,100
0048               STARS(J)=STAR
0049          501 CONTINUE
              C
0050               Q1=0.
0051               Q2=0.
0052               WRITE (6,200)
0053               READ (5,110) SCRITT
0054               WRITE (6,230) SCRITT
0055               WRITE (6,264)
0056               DO 5 J=1,3
0057               READ (5,110) SCRITT
0058               WRITE (6,230) SCRITT
0059               WRITE (6,232)
0060               READ (5,110) SCRITT
0061               WRITE (6,230) SCRITT
0062               WRITE (6,231)
0063               READ (5,101) NB(J)
0064               NBB=NB(J)
0065               DO 1 K=1,NBB
0066               READ (5,104) T(J,K),XX(J,K),YY(J,K)
0067             1 CONTINUE
0068               A1=0.
0069               A2=0.
0070               A3=0.
0071               NBB=NB(J)
0072               DO 2 K=1,NBB
0073               A1=A1+T(J,K)*XX(J,K)
0074               A2=A2+T(J,K)*YY(J,K)
0075               A3=A3+T(J,K)
0076             2 CONTINUE
0077               DO 4 K=1,NBB
```

```
0078              P(J,K)=T(J,K)/A3
0079            4 CONTINUE
0080              XC(J)=A1/A3
0081              YC(J)=A2/A3
0082              WRITE (6,212) (K,(T(J,K),XX(J,K),YY(J,K)),K=1,NBB)
0083              WRITE (6,232)
0084              READ (5,110) SCRITT
0085              WRITE (6,230) SCRITT
0086              WRITE (6,231)
0087              WRITE (6,208) (J,NB(J),XC(J),YC(J))
0088              WRITE (6,264)
0089            5 CONTINUE
                C
0090              DO 6 J=1,3
0091              NBB=NB(J)
0092              DO 6 K=1,NBB
0093              XX(J,K)=XX(J,K)-XC(J)
0094              YY(J,K)=YY(J,K)-YC(J)
0095            6 CONTINUE
                C
0096              C1=XC(1)
0097              C2=XC(2)
0098              C3=XC(3)
0099              D1=YC(1)
0100              D2=YC(2)
0101              D3=YC(3)
                C
0102              WRITE (6,200)
0103              READ (5,110) SCRITT
0104              WRITE (6,230) SCRITT
0105              WRITE (6,264)
0106              READ (5,110) SCRITT
0107              WRITE (6,230) SCRITT
0108              READ (5,110) SCRITT
0109              WRITE (6,230) SCRITT
0110              WRITE (6,231)
0111              READ (5,101) NBATCH
0112              READ (5,103) ((M(J),SM(J),X(J),SX(J),Y(J),SY(J)),J=1,NBATCH)
0113              DO 9 J=1,NBATCH
0114              WRITE (6,205)  (J,M(J),SM(J),X(J),SX(J),Y(J),SY(J))
0115            9 CONTINUE
                C
0116              MM=0.
0117              DET=C1*D2+D3*C2+C3*D1-C1*D3-C2*D1-C3*D2
0118              DO 14 K=1,NBATCH
0119              AM=          X(K)*(D2-D3)+C2*(D3-Y(K))+C3*(Y(K)-D2)
0120              BM(K)=M(K)*AM/DET
0121              MM=MM+BM(K)
```

```
0122          14 CONTINUE
0123             WRITE (6,235)
0124             WRITE (6,233) ((K,BM(K)),K=1,NBATCH)
0125             WRITE (6,209) MM
               C
               C              ******      ******      ******      ******
               C
0126             WRITE (6,200)
0127             READ (5,116) SCRITT
0128             WRITE (6,230) SCRITT
0129             READ (5,101) IX
0130             READ (5,103) RNO
0131             CALL SETRND(RNO)
0132             READ (5,101) NPROVE
0133             PROVE=NPROVE
0134             READ (5,103) QMS,DM
0135             WRITE (6,201) IX,RNO
0136             WRITE (6,202) NPROVE
0137             C=100./FLOAT(NPROVE)
0138             READ (5,101) NCL
0139             READ (5,102) (CL(J),J=1,NCL)
0140             READ (5,101) IPUNCH
               C
0141             DO 71 LG=1,62
0142          71 LD(LG)=0
               C
0143             LX=INT(QMS/DM)
0144             IF(LX.LT.30) GO TO 50
0145             QMS=30*DM
0146             LMX=62
0147             WRITE (6,238) QMS
0148             GO TO 52
0149          50 CONTINUE
0150             AMM=MM-QMS
0151             IF(AMOD(QMS,DM).LT.(DM*0.01)) GO TO 51
0152             LX=LX+1
0153             QMS=LX*DM
0154          51 CONTINUE
0155             LMX=2*LX+2
0156          52 CONTINUE
0157             Q(1)=MM-DM*(FLOAT(LX)+0.5)
0158             DO 55 J=2,LMX
0159             Q(J)=Q(1)+(J-1)*DM
0160          55 CONTINUE
               C
0161             DO 13 L=1,NPROVE
0162             DO 31 J=1,3
0163             A1=0.
```

```
0164                A2=0.
0165                A3=0.
0166                NBB=NB(J)
0167                DO 32 K=1,NBB
0168                A4=RANDOM(0.)*T(J,K)
0169                A1=A1+XX(J,K)*A4
0170                A2=A2+YY(J,K)*A4
0171                A3=A3+A4
0172             32 CONTINUE
0173                EXJ(J)=XC(J)+A1/A3
0174                EYJ(J)=YC(J)+A2/A3
0175             31 CONTINUE
0176                EC1=EXJ(1)
0177                EC2=EXJ(2)
0178                EC3=EXJ(3)
0179                ED1=EYJ(1)
0180                ED2=EYJ(2)
0181                ED3=EYJ(3)
0182            415 DET=EC1*ED2+EC2*ED3+EC3*ED1-EC1*ED3-EC2*ED1-EC3*ED2
0183                DO 11 K=1,NBATCH
0184            417 CALL GAUSS(IX,SM(K),M(K),EM(K))
0185            418 CALL GAUSS(IX,SX(K),X(K),EX(K))
0186            419 CALL GAUSS(IX,SY(K),Y(K),EY(K))
0187            420 EQ(K)=EX(K)*(ED2-ED3)+EC2*(ED3-EY(K))+EC3*(EY(K)-ED2)
0188             11 CONTINUE
0189                EQQ=0.
0190                DO 12 K=1,NBATCH
0191                EQQ=EQQ+EQ(K)*EM(K)
0192             12 CONTINUE
0193                EQQ=EQQ/DET
                C                                                          PS
0194                Q1=Q1+EQQ
0195                Q2=Q2+EQQ*EQQ
0196                LG=(EQQ-AMM)/DM+2
0197                IF (LG.LT.1) LG=1
0198                IF (LG.GT.LMX) LG=LMX
0199                LD(LG)=LD(LG)+1
0200             13 CONTINUE
                C
0201                VMED=Q1/NPROVE
0202                VAR=Q2/NPROVE-VMED*VMED
0203                SDEV=SQRT(VAR)
0204                PERC=(SDEV/VMED)*100.
                C
0205                I=1
0206                CCC=CL(I)
0207                NUM(1)=LD(1)
0208                ANUM(1)= NUM(1)*C
```

```
0209                DO 513 J=2,LMX
0210                J1=J-1
0211                NUM(J)=NUM(J1)+LD(J)
0212                ANUM(J)=NUM(J)*C
0213                IF (I.GT.NCL) GO TO 57
0214                IF(ANUM(J).LT.CCC) GO TO 57
0215                QL(I)=Q(J)-DM*(ANUM(J)-CCC)/(ANUM(J)-ANUM(J-1))
0216                I=I+1
0217                CCC=CL(I)
0218             57 CONTINUE
0219            513 CONTINUE
              C
0220                WRITE (6,203) VMED,SDEV,PERC,MM
0221                WRITE (6,236)
0222                DO 59 J=1,NCL
0223                QC=QL(J)-VMED
0224                QC=QL(J)-MM
0225                WRITE (6,237) (J,CL(J),QD,QL(J))
0226             59 CONTINUE
              C
0227                WRITE (6,226) DM
0228                LMX1=LMX-1
0229                WRITE (6,227) (LD(LG),LG=1,LMX)
0230                I=LD(1)
0231                DO 15 J=2,LMX
0232                K=LD(J)
0233                I=MAX0(I,K)
0234             15 CONTINUE
0235                DO 16 J=2,LMX1
0236                K7(J)=LD(J)*50/I
0237             16 CONTINUE
              C
0238                DO 520 J=1,LMX
0239                PDF(J)=FLOAT(LD(J))/PROVE
0240            520 CONTINUE
              C
0241                IF (IPUNCH.NE.777) GO TO 521
0242                IN=1
0243                DO 60 J=1,LMX
0244                IF (PDF(J).NE.0.) GO TO 61
0245                IN=IN+1
0246             60 CONTINUE
0247             61 CONTINUE
0248                IL=LMX
0249                DO 62 J=1,LMX
0250                K=LMX-J+1
0251                IF (PDF(K).NE.0.) GO TO 63
0252                IL=IL-1
```

```
0253            62 CONTINUE
0254            63 CONTINUE
0255               LU=IL-IN+1
0256               WRITE (7,301) LU
0257               WRITE (7,303) (Q(IN),VMED,SDEV)
0258               WRITE (7,302) (PDF(J),J=IN,IL)
0259           521 CONTINUE
               C
0260               WRITE (6,264)
0261               WRITE (6,222)
0262               DO 500 JJ=2,LMX1
0263               LLL=K7(JJ)
0264               IF (LLL.LE.0) GO TO 499
0265               WRITE (6,228) (Q(JJ),PDF(JJ),(STARS(J),J=1,LLL))
0266               GO TO 500
0267           499 CONTINUE
0268               WRITE (6,225) (Q(JJ),PDF(JJ))
0269           500 CONTINUE
               C
0270               WRITE (6,200)
0271               WRITE (6,227) (NUM(J),J=1,LMX)
0272               WRITE (6,264)
               C
0273               WRITE (6,223)
0274               DO 511 J=2,LMX
0275               PDF(J)=PDF(J-1)+PDF(J)
0276           511 CONTINUE
               C
0277               UM=NUM(LMX)
0278               F=100./UM
0279               DO 514  LG=1,LMX
0280               LD(LG)=NUM(LG)*F
0281           514 CONTINUE
0282               DO 515 JJ=1,LMX
0283               LLL=LD(JJ)
0284               IF (LLL.LE.0) GO TO 516
0285               WRITE (6,228) (Q(JJ),PDF(JJ),(STARS(J),J=1,LLL))
0286               GO TO 515
0287           516 CONTINUE
0288               WRITE (6,225) (Q(JJ),PDF(JJ))
0289           515 CONTINUE
               C
0290               STOP
0291               END
```

The subroutines

SETRAND (RANDOM)

GAUSS

RANDU

are listed together with the CC2 code

```
LIST OF THE DATA CARDS USED FOR THE "CC3" SAMPLE PROGRAM


 **  INPUT BATCH DATA **
    CANDU REACTOR
BATCH    PU MASS (G)     PU-41 CONC.     PU-42 CONC.
         4
3434. 4     3. 41        0. 585
3218. 4     3. 67        1. 05
3381. 0     3. 81        1. 11
3386. 7     3. 72        1. 09
  REACTOR   BATCHES            MEAN   VALUES
    VAK REACTOR
BATCH    PU MASS (G)     PU-41 CONC.     PU-42. CONC.
         4
3103. 5     7. 53        1. 97
2109. 6     8. 08        2. 30
4309. 0     8. 18        2. 42
 702. 7     7. 74        1. 78
  REACTOR   BATCHES            MEAN   VALUES
    TRINO REACTOR
BATCH    PU MASS (G)     PU-41 CONC.     PU-42 CONC.
         2
3420. 3     7. 18        1. 19
3149. 8     5. 94        0. 90
  REACTOR   BATCHES            MEAN   VALUES
 **  OUTPUT BATCH DATA **
         PU-MASS (G)          PU-41 CONC.          PU-42 CONC.
NO.   VALUE      ST. DEV.    PERCENT   ST. DEV.    PERCENT   ST. DEV.
         1
5415. 7     20. 0785     6. 575    0. 032875    1. 250     0. 01625
 **  STATISTICAL ANALYSIS INPUT DATA  **
       357
    357.
    10000                                                        NPROVE
  900.          50.                                              CMS   DM
         8
     2. 5         5. 0        10.          20.          80.
    90.          95.         97. 5
       777                                        REQUESTED PUNCHED CARDS
```

** INPUT BATCH DATA **

CANDU REACTOR

BATCH	PU MASS (G)	PU-41 CONC.	PU-42 CONC.
1	3434.3999	3.4100	0.9850
2	3218.3999	3.6700	1.0500
3	3381.0000	3.8100	1.1100
4	3386.7000	3.7200	1.0900

REACTOR	BATCHES	MEAN VALUES	
1	4	3.6514	1.0586

VAK REACTOR

BATCH	PU MASS (G)	PU-41 CONC.	PU-42 CONC.
1	3103.5000	7.5300	1.9700
2	2109.5999	8.0800	2.3000
3	4309.0000	8.1800	2.4200
4	702.7000	7.7400	1.7800

REACTOR	BATCHES	MEAN VALUES	
2	4	7.9318	2.2147

TRINO REACTOR

BATCH	PU MASS (G)	PU-41 CONC.	PU-42 CONC.
1	3420.2998	7.1800	1.1900
2	3149.7998	5.9400	0.9000

REACTOR	BATCHES	MEAN VALUES	
3	2	6.5855	1.0510

** OUTPUT BATCH DATA **

NO.	PU-MASS (G) VALUE	PU-MASS (G) ST. DEV.	PU-241 CONC. PERCENT	PU-241 CONC. ST. DEV.	PU-242 CONC. PERCENT	PU-242 CONC. ST. DEV.
1	5415.6992	20.0785	6.5750	0.0329	1.2500	0.0162

PART OF THE INVENTORY CONTAINED IN EACH OUTPUT BATCH

H(1) = 443.10

TOTAL = 443.10

** STATISTICAL ANALYSIS INPUT DATA **

INITIAL NUMBER FOR SUBROUTINE 'GAUSS' 357
INITIAL NUMBER FOR SUBROUTINE 'RANDOM' (SETRAND) 357
NUMEROSITY OF THE SAMPLE FOR STATISTICAL ANALYSIS 1000

** STATISTICAL ANALYSIS RESULTS **

MEAN VALUE	431.8501
STANDARD DEVIATION	308.2153
PERCENT ST. DEV.	71.3769
MEDIAN VALUE	443.1021

CONFIDENCE INTERVALS

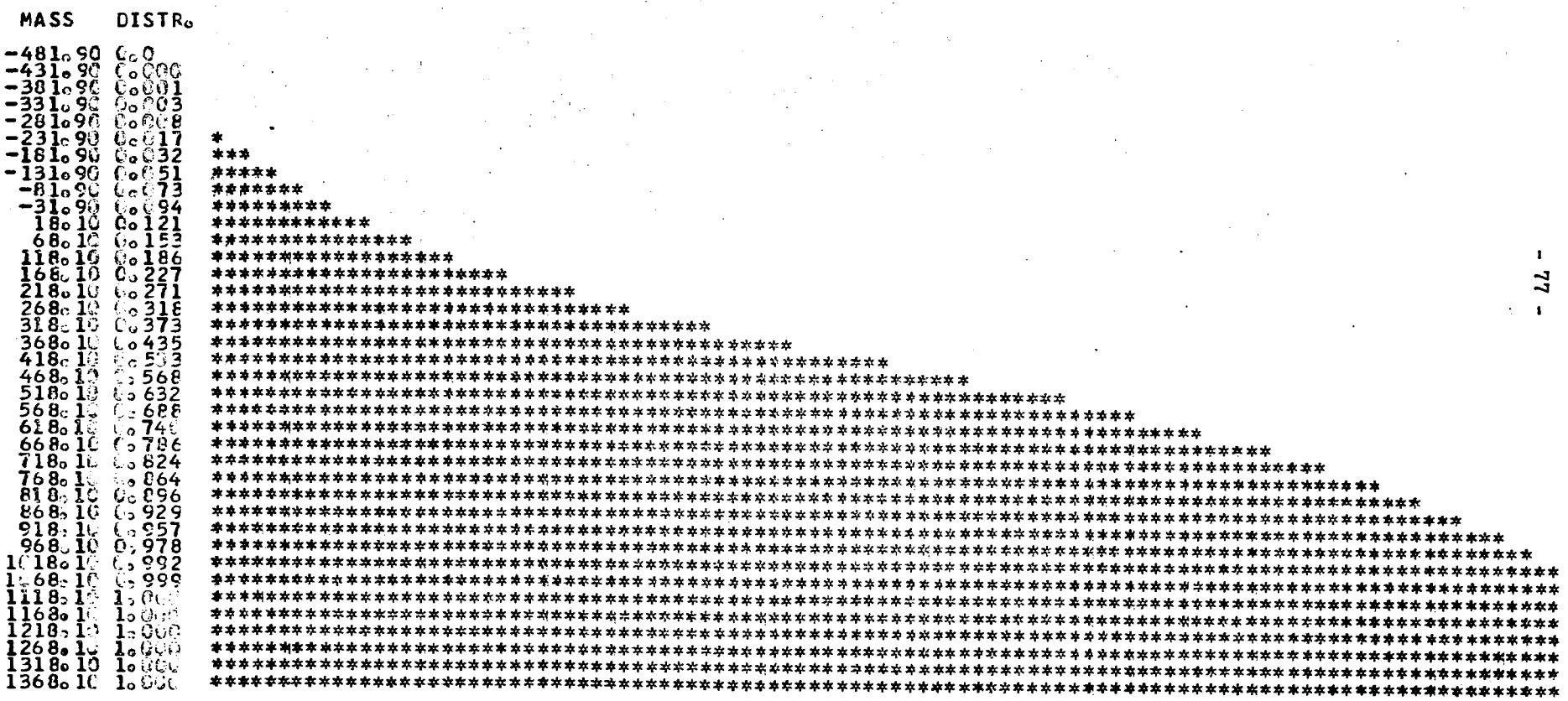
	P(X)	X-MEAN	X
1	2.5	-636.26	-204.41
2	5.0	-566.10	-134.25
3	10.0	-453.18	-21.33
4	20.0	-296.56	135.29
5	80.0	254.69	686.54
6	90.0	391.89	823.74
7	95.0	473.84	905.69
8	97.5	528.94	960.79

PROCESS INVENTORY DISTRIBUTION, STEP= 50.

0	1	8	18	50	90	151	191	219	216
265	321	328	413	439	475	546	624	680	650
631	569	515	458	385	397	323	328	278	212
136	70	12	1	0	0	0	0		

MASS	PDF	
-431.90	0.000	
-381.90	0.001	
-331.90	0.002	*
-281.90	0.005	***
-231.90	0.009	******
-181.90	0.015	**********
-131.90	0.019	**************
-81.90	0.022	*****************
-31.90	0.022	*****************
18.10	0.026	********************
68.10	0.032	************************
118.10	0.033	*************************
168.10	0.041	*******************************
218.10	0.044	**********************************
268.10	0.047	************************************
318.10	0.055	**
368.10	0.062	**
418.10	0.068	***
468.10	0.065	**
518.10	0.063	**
568.10	0.057	**
618.10	0.051	**
668.10	0.046	************************************
718.10	0.038	*****************************
768.10	0.040	*******************************
818.10	0.032	************************
868.10	0.033	*************************
918.10	0.028	*********************
968.10	0.021	****************
1018.10	0.014	**********
1068.10	0.007	*****
1118.10	0.001	
1168.10	0.000	
1218.10	0.0	
1268.10	0.0	
1318.10	0.0	

0	1	9	27	77	167	318	509	728	944
1209	1530	1858	2271	2710	3185	3731	4355	5035	5685
6316	6885	7400	7858	8243	8640	8963	9291	9569	9781
9917	9987	9999	10000	10000	10000	10000	10000		



```
C
C
C      COMPUTER CODE MUF
C
C
0001          IMPLICIT REAL*8(A-H,O-Z)
0002          DIMENSION V1(900),V2(900),VX(900),T(900)
0003          DIMENSION TT(900)
0004          DIMENSION KS(900)
0005          DIMENSION QL(20),CL(20)
0006          DIMENSION Q(900)
0007          DIMENSION D4(900),V4(900)
0008          DIMENSION STARS(100)
0009          REAL*4 SUM/' + '/
0010          REAL*4 DIFF1/'1-2'/
0011          REAL*4 DIFF2/'2-1'/
0012          REAL*4 ALT/'ALT'/
0013          REAL*4 STAR/'*'/
0014          REAL*4 CONV
0015      101 FORMAT (5I10)
0016      102 FORMAT (5F10.0)
0017      104 FORMAT (5F12.0)
0018      105 FORMAT (A3)
0019      200 FORMAT (1H1)
0020      201 FORMAT (///)
0021      202 FORMAT (1H ,10F11.8)
0022      203 FORMAT (1H ,10I5)
0023      204 FORMAT (///,1H ,2F15.5)
0024      209 FORMAT (1H1,
             1'  CONVOLUTIONS OF A SEQUENCE OF PROBABILITY DENSITY FUNCTIONS',/,
             2'  (P.D.F.) GIVEN IN HISTOGRAM FORM. FOR EACH  HYSTOGRAM THE',/,
             3'  VALUE IS FIX AND EQUAL TO',F6.2)
0025      210 FORMAT (' RELEVANT DATA OF THE P.D.F. *1*',/)
0026      211 FORMAT (/////,' RELEVANT DATA OF THE P.D.F. *2*',/)
0027      212 FORMAT (/////,7X,A3,'  CONVOLUTION REQUIRED BETWEEN P.D.F. *1* AND
             1 P.D.F. *2*')
0028      213 FORMAT (1H1,'  RESULT OF THE CONVOLUTION ',A3,/////)
0029      214 FORMAT ('  RESULTING P.D.F',///)
0030      215 FORMAT (///,'  RESULTING DISTRIBUTION FUNCTION',///)
0031      216 FORMAT (/,I10,' NUMBER OF THE HISTOGRAM POINTS',
             1/,F10.2,' ABSCISSA OF THE FIRST POINT',
             2/,F10.2,' MEAN VALUE OF THE DISTRIBUTION',
             3/,F10.3,' STANDARD DEVIATION OF THE MEAN',///)
0032      217 FORMAT (////,' RELEVANT DATA',/)
0033      222 FORMAT (1H ,'     MASS     PDF',/)
0034      223 FORMAT (1H ,'     MASS    DISTR.',/)
0035      225 FORMAT (1H ,F10.2,F7.4)
0036      228 FORMAT (1H ,F10.2,F7.4,2X,100A1)
```

```
0037          236 FORMAT ('   CONFIDENCE INTERVALS',///,
                 1'          P(%)          X-MEAN          X'//)
0038          237 FORMAT (I5,F8.1,2F12.2)
0039          240 FORMAT (1H ,F10.8,101A1)
              C
0040              DO 501 J=1,100
0041              STARS(J)=STAR
0042          501 CONTINUE
              C
0043              READ (5,102) PASSO
0044              WRITE (6,209) PASSO
0045              ASSIGN 50 TO IADD
0046              READ (5,101) NCL
0047              READ (5,102) (CL(J),J=1,NCL)
              C
0048              READ (5,101) N1
0049              IF (N1.NE.999) GO TO 40
              C
0050              ASSIGN 51 TO IADD
0051              N2=N1
              C
0052           52 CONTINUE
0053              READ (5,102) Q2MED,Q2SD
0054              DD=PASSO/Q2SD
0055              NN=3./DD
0056              IF (NN.LT.1) NN=1
0057              X=-NN*DD
0058              CALL NDTR(X,P,D)
0059              D4(1)=P
0060              V2(1)=P
0061              NBX=2*NN+1
0062              DO 27 J=2,NBX
0063              J1=J-1
0064              X=(J1-NN)*DD
0065              CALL NDTR(X,P,D)
0066              D4(J)=P
0067              V2(J)=P-D4(J1)
0068           27 CONTINUE
0069              N2=NBX+1
0070              Q2=Q2MED-(FLOAT(N2)-0.5)*PASSO
0071              V2(N2)=1.-D4(NBX)
0072              D4(N2)=1.
0073              GO TO IADD,(50,51)
              C
0074           51 CONTINUE
0075              N1=N2
0076              Q1=Q2
0077              Q1SD=Q2SD
```

```
0078                Q1MED=Q2MED
0079                DO 54 J=1,N1
0080                V1(J)=V2(J)
0081             54 CONTINUE
0082                ASSIGN 50 TO IADD
0083                GO TO 41
                C
0084             40 CONTINUE
0085                READ (5,102) Q1,Q1MED,Q1SD
0086                READ (5,104) (V1(J),J=1,N1)
                C
                C                  ooooooooooooo
                C
0087             41 CONTINUE
0088                READ (5,105) CONV
0089                IF (CONV.EQ.ALT) GO TO 59
0090                READ (5,101) ICONF
0091                READ (5,101) ISTARS
                C
0092                READ (5,101) N2
0093                IF (N2.EQ.999) GO TO 53
                C
0094                READ (5,102) Q2,Q2MED,Q2SD
0095                READ (5,104) (V2(J),J=1,N2)
                C
0096             50 CONTINUE
0097                WRITE (6,200)
0098                WRITE (6,210)
0099                WRITE (6,216) N1,Q1,Q1MED,Q1SD
0100                WRITE (6,202) (V1(J),J=1,N1)
0101                WRITE (6,211)
0102                WRITE (6,216) N2,Q2,Q2MED,Q2SD
0103                WRITE (6,202) (V2(J),J=1,N2)
0104                WRITE (6,212) CONV
                C
0105                IF (CONV.NE.SUM) GO TO 58
                C
0106             24 CONTINUE
0107                IF (N2.GE.N1) GO TO 4
                C
                C      N1 MUST BE LOWER THAN N2
0108                DO 1 J=1,N1
0109              1 VX(J)=V1(J)
0110                DO 2 J=1,N2
0111              2 V1(J)=V2(J)
0112                DO 3 J=1,N1
0113              3 V2(J)=VX(J)
0114                NX=N1
```

```
0115                N1=N2
0116                N2=NX
0117                QX=Q1
0118                Q1=Q2
0119                Q2=QX
0120                QY=Q1MED
0121                Q1MED=Q2MED
0122                Q2MED=QY
                C
0123              4 CONTINUE
0124                N=N1+N2
0125                TT(1)=0.
0126                E=0.
0127                V=0.
0128                DO 10 M=2,N
0129                L1=1
0130                L2=N1
0131                IF((M-1).LT.N1) L2=M-1
0132                IF ((M-N2).GT.1) L1=M-N2
0133                T(M)=0
0134                DO 9 L=L1,L2
0135                ML=M-L
0136                T(M)=T(M)+V1(L)*V2(ML)
0137              9 CONTINUE
0138                MM=M-1
0139                TT(M)=TT(MM)+T(M)
0140                R=MM
0141                E=E+R*T(M)
0142                V=V+R*R*T(M)
0143             10 CONTINUE
                C
0144                Q1=Q1+Q2
0145                Q1MED=Q1+(E-1.)*PASSO
0146                V=DSQRT(V-E*E)
0147                Q1SD=V*PASSO
0148                NJ=N-1
0149                DO 43 J=1,NJ
0150                V1(J)=T(J+1)
0151             43 CONTINUE
0152                WRITE (6,213) LDRW
0153                WRITE (6,214)
0154                WRITE (6,202) (V1(M),M=1,N1)
0155                WRITE (6,215)
0156                WRITE (6,202) (TT(M),M=2,N)
0157                WRITE (6,217)
0158                WRITE (6,216) N1,Q1,Q1MED,Q1SD
                C
0159                Q(1)=Q1
```

```
0160                DO 75 J=2,N1
0161                Q(J)=Q1+PASSO*FLOAT(J-1)
0162             75 CONTINUE
0163                DO 76 J=1,N1
0164                TT(J)=TT(J+1)
0165             76 CONTINUE
                 C
0166                IF (ICONF.NE.777) GO TO 20
0167                I=1
0168                CCC=CL(I)/100.
0169                DO 70 J=2,N1
0170                J1=J-1
0171                IF (TT(J).LT.CCC) GO TO 70
0172                QL(I)=Q(J)-PASSO*(TT(J)-CCC)/(TT(J)-TT(J-1))
0173                I=I+1
0174                IF (I.GT.NCL) GO TO 71
0175                CCC=CL(I)/100.
0176             70 CONTINUE
0177             71 CONTINUE
0178                WRITE (6,213) CONV
0179                WRITE (6,236)
0180                DO 78 J=1,NCL
0181                QD=QL(J)-Q1MED
0182                WRITE (6,237) (J,CL(J),QD,QL(J))
0183             78 CONTINUE
0184             20 CONTINUE
                 C
0185                IF (ISTARS.NE.888) GO TO 19
                 C       PLOT NEL CASO DELLE CONV = +
0186                WRITE (6,200)
0187                CALL STELLE(V1,N1, 50,KS)
0188                WRITE (6,222)
0189                DO 80 J=1,N1
0190                LLL=KS(J)
0191                IF (LLL.LE.0) GO TO 81
0192                WRITE (6,228) (Q(J),V1(J),(STARS(JJ),JJ=1,LLL))
0193                GO TO 80
0194             81 CONTINUE
0195                WRITE (6,225) (Q(J),V1(J))
0196             80 CONTINUE
                 C
0197                WRITE (6,200)
0198                CALL STELLE(TT,N1,100,KS)
0199                WRITE (6,223)
0200                DO 82 J=1,N1
0201                LLL=KS(J)
0202                IF (LLL.LE.0) GO TO 83
0203                WRITE (6,228) (Q(J),TT(J),(STARS(JJ),JJ=1,LLL))
```

```
0204                GO TO 82
0205             83 CONTINUE
0206                WRITE (6,225) (Q(J),TT(J))
0207             82 CONTINUE
0208             19 CONTINUE
0209                GO TO 41
                 C
                 C
                 C
                 C
                 C
                 C
0210             58 CONTINUE
0211                IF (CONV.EQ.DIFF1) GO TO 57
                 C
0212                DO 66 J=1,N1
0213             66 VX(J)=V1(J)
0214                DO 64 J=1,N2
0215             64 V1(J)=V2(J)
0216                DO 65 J=1,N1
0217             65 V2(J)=VX(J)
0218                NX=N1
0219                N1=N2
0220                N2=NX
0221                QX=Q1
0222                Q1=Q2
0223                Q2=QX
0224                QY=Q1MED
0225                Q1MED=Q2MED
0226                Q2MED=QY
0227                QZ=Q1SD
0228                Q1SD=Q2SD
0229                Q2SD=QZ
0230             57 CONTINUE
                 C
0231                E=0.
0232                V=0.
0233                N=N1+N2-1
0234                DO 12 MN=1,N
0235                R=MN
0236                M=MN-N2
0237                L1=MAXO(1,(1-M))
0238                L2=MINO(N2,(N1-M))
0239                T(MN)=0.
0240                DO 11 L=L1,L2
0241                LM=L+M
0242                T(MN)=T(MN)+V1(LM)*V2(L)
0243             11 CONTINUE
```

```
0244                E=E+R*T(MN)
0245                V=V+R*R*T(MN)
0246             12 CONTINUE
0247                TT(1)=T(1)
0248                DO 13 M=2,N
0249                M1=M-1
0250                TT(M)=TT(M1)+T(M)
0251             13 CONTINUE
                 C
0252                Q1=Q2-Q1-PASSO*FLOAT(N1-1)
0253                Q1MED=Q1+(E-1.)*PASSO
0254                V=DSQRT(V-E*E)
0255                Q1SD=V*PASSO
0256                N1=N
0257                DO 14 J=1,N
0258                V1(J)=T(J)
0259             14 CONTINUE
                 C
0260                WRITE (6,213) CONV
0261                WRITE (6,214)
0262                WRITE (6,202) (V1(M),M=1,N1)
0263                WRITE (6,215)
0264                WRITE (6,202) (TT(M),M=1,N)
0265                WRITE (6,217)
0266                WRITE (6,216) N1,Q1,Q1MED,Q1SD
                 C
0267                Q(1)=Q1
0268                DO 74 J=2,N1
0269                Q(J)=Q1+PASSO*FLOAT(J-1)
0270             74 CONTINUE
                 C
0271                IF (ICONF.NE.777) GO TO 22
0272                I=1
0273                CCC=CL(I)/100.
0274                DO 72 J=2,N1
0275                J1=J-1
0276                IF (TT(J).LT.CCC) GO TO 72
0277                QL(I)=Q(J)-PASSO*(TT(J)-CCC)/(TT(J)-TT(J-1))
0278                I=I+1
0279                IF (I.GT.NCL) GO TO 73
0280                CCC=CL(I)/100.
0281             72 CONTINUE
0282             73 CONTINUE
0283                WRITE (6,213) CONV
0284                WRITE (6,236)
0285                DO 77 J=1,NCL
0286                QD=QL(J)-Q1MED
0287                WRITE (6,237) (J,CL(J),QD,QL(J))
```

```
0288            77 CONTINUE
0289            22 CONTINUE
          C
0290               IF (ISTARS.NE.888) GO TO 16
0291               WRITE (6,200)
0292               CALL STELLE (T,N,50,KS)
0293               WRITE (6,222)
0294               DO 60 J=1,N
0295               LLL=KS(J)
0296               IF (LLL.LE.0) GO TO 61
0297               WRITE (6,228) (Q(J),V1(J),(STARS(JJ),JJ=1,LLL))
0298               GO TO 60
0299            61 CONTINUE
0300               WRITE (6,225) (Q(J),V1(J))
0301            60 CONTINUE
          C
0302               WRITE (6,200)
0303               CALL STELLE (TT,N,100,KS)
0304               WRITE (6,223)
0305               DO 62 J=1,N
0306               LLL=KS(J)
0307               IF (LLL.LE.0) GO TO 63
0308               WRITE (6,228) (Q(J),TT(J),(STARS(JJ),JJ=1,LLL))
0309               GO TO 62
0310            63 CONTINUE
0311               WRITE (6,225) (Q(J),TT(J))
0312            62 CONTINUE
0313            16 CONTINUE
0314               GO TO 41
0315            99 CONTINUE
0316               STOP
0317               END
```



```
0001               SUBROUTINE STELLE (T,N,NORM,K)
0002               IMPLICIT REAL*8(A-H,O-Z)
0003               DIMENSION T(900),K(900)
0004               B=T(1)
0005               DO 1 J=2,N
0006               TJ=T(J)
0007               B=DMAX1(B,TJ)
0008             1 CONTINUE
0009               ORM=NORM
0010               DO 2 J=1,N
0011               C=(T(J)/B)*ORM
0012               K(J)=C
0013             2 CONTINUE
0014               RETURN
0015               END
```

```
C                                                                               NDTR  10
C.....................................................................          NDTR  20
C                                                                               NDTR  30
C         SUBROUTINE NDTR                                                       NDTR  40
C                                                                               NDTR  50
C         PURPOSE                                                               NDTR  60
C            COMPUTES Y = P(X) = PROBABILITY THAT THE RANDOM VARIABLE  U,        NDTR  70
C            DISTRIBUTED NORMALLY(0,1), IS LESS THAN OR EQUAL TO X.             NDTR  80
C            F(X), THE ORDINATE OF THE NORMAL DENSITY AT X, IS ALSO             NDTR  90
C            COMPUTED.                                                          NDTR 100
C                                                                               NDTR 110
C         USAGE                                                                 NDTR 120
C            CALL NDTR(X,P,D)                                                   NDTR 130
C                                                                               NDTR 140
C         DESCRIPTION OF PARAMETERS                                             NDTR 150
C            X--INPUT SCALAR FOR WHICH P(X) IS COMPUTED.                        NDTR 160
C            P--OUTPUT PROBABILITY.                                             NDTR 170
C            D--OUTPUT DENSITY.                                                 NDTR 180
C                                                                               NDTR 190
C         REMARKS                                                               NDTR 200
C            MAXIMUM ERROR IS 0.0000007.                                        NDTR 210
C                                                                               NDTR 220
C         SUBROUTINES AND SUBPROGRAMS REQUIRED                                  NDTR 230
C            NONE                                                               NDTR 240
C                                                                               NDTR 250
C         METHOD                                                                NDTR 260
C            BASED ON APPROXIMATIONS IN C. HASTINGS, APPROXIMATIONS FOR         NDTR 270
C            DIGITAL COMPUTERS, PRINCETON UNIV. PRESS, PRINCETON, N.J.,         NDTR 280
C            1955.  SEE EQUATION 26.2.17, HANDBOOK OF MATHEMATICAL              NDTR 290
C            FUNCTIONS, ABRAMOWITZ AND STEGUN, DOVER PUBLICATIONS, INC.,        NDTR 300
C            NEW YORK.                                                          NDTR 310
C                                                                               NDTR 320
C.....................................................................          NDTR 330
C                                                                               NDTR 340
0001            SUBROUTINE NDTR(X,P,D)                                          NDTR 350
0002            IMPLICIT REAL*8(A-H,O-Z)
C                                                                               NDTR 360
0003            AX=DABS(X)                                                      NDTR 37
0004            T=1.0/(1.0+.2316419*AX)                                         NDTR 380
0005            D=0.3989423*DEXP(-X*X/2.0)                                      NDTR 390
0006            P = 1.0 - D*T*(((((1.330274*T - 1.821256)*T + 1.781478)*T -     NDTR 400
               1  0.3565638)*T + 0.3193815)                                     NDTR 410
0007             IF(X)1,2,2                                                     NDTR 420
0008           1 P=1.0-P                                                        NDTR 430
0009           2 RETURN                                                         NDTR 440
0010             END                                                            NDTR 450
```

```
°°°LIST OF THE DATA CARDS USED FOR THE 'MUF' SAMPLE PROGRAM
°°°


 50.
          8
2.5          5.0          10.0          20.0          80.0
90.0          95.0          97.5
        999
  7802.          27.8
 +
        777                                          CONFIDENCE LIMITS REQUIRED
        666                                                PLOT REQUIRED
          31
   1942.75     2849.87      255.95
   0.0001000    0.0003000    0.0002000    0.0011000    0.0021000
   0.0035000    0.0056000    0.0068000    0.0094000    0.0121000
   0.0183000    0.0248000    0.0321000    0.0369000    0.0487000
   0.0569000    0.0641000    0.0797000    0.0883000    0.0926000
   0.0858000    0.0786999    0.0707999    0.0627000    0.0491000
   0.0340000    0.0227000    0.0092000    0.0029000    0.0004000
   0.0001000
 +
        777                                          CONFIDENCE LIMITS REQUIRED
        666                                                PLOT REQUIRED
          33                                                          PU/1  3
  -431.90      431.85      308.22                                     PU/1  3C
   0.0001000    0.0008000    0.0018000    0.0050000    0.0090000     PU/1  3C
   0.0151000    0.0191000    0.0219000    0.0216000    0.0265000     PU/1  3C
   0.0321000    0.0328000    0.0413000    0.0439000    0.0475000     PU/1  3C
   0.0546000    0.0624000    0.0680000    0.0650000    0.0631000     PU/1  3C
   0.0569000    0.0515000    0.0458000    0.0385000    0.0397000     PU/1  3C
   0.0323000    0.0318000    0.0276000    0.0212000    0.0136000     PU/1  3C
   0.0070000    0.0012000    0.0001000                               PU/1  3C
4-1
        777                                          CONFIDENCE LIMITS REQUIRED
        666                                                PLOT REQUIRED
        999
 11190.          141.
ALT
```

CONVOLUTIONS OF A SEQUENCE OF PROBABILITY DENSITY FUNCTIONS
(P.D.F.) GIVEN IN HISTOGRAM FORM. FOR EACH HYSTOGRAM THE
VALUE IS FIX AND EQUAL TO 50.00

RELEVANT DATA OF THE P.D.F. *1*

4 NUMBER OF THE HISTOGRAM POINTS
7627.00 ABSCISSA OF THE FIRST POINT
7802.00 MEAN VALUE OF THE DISTRIBUTION
27.800 STANDARD DEVIATION OF THE MEAN

0.03604401 0.46395619 0.46395579 0.03604401

RELEVANT DATA OF THE P.D.F. *2*

31 NUMBER OF THE HISTOGRAM POINTS
1942.75 ABSCISSA OF THE FIRST POINT
2849.87 MEAN VALUE OF THE DISTRIBUTION
255.950 STANDARD DEVIATION OF THE MEAN

0.00010000 0.00030000 0.00020000 0.00110000 0.00210000 0.00350000 0.00560000 0.00680000 0.00940000 0.01210000
0.01830000 0.02480000 0.03210000 0.03690000 0.04870000 0.05690000 0.06410000 0.07570000 0.08830000 0.09260000
0.08580000 0.07869990 0.07079990 0.06270000 0.04910000 0.03400000 0.02270000 0.00520000 0.00290000 0.00040000
0.00010000

\+ CONVOLUTION REQUIRED BETWEEN P.D.F. *1* AND P.D.F. *2*

RESULT OF THE CONVOLUTION +

RESULTING P.D.F.

0.00000360 0.00005721 0.00019279 0.00027523 0.00068965 0.00161802 0.00283965 0.00454279 0.00621802 0.00815487
0.01087976 0.01533697 0.02156965 0.02838673 0.03466220 0.04292255 0.05263420 0.06476673 0.07955546 0.08359278
0.08969492 0.08878909 0.08221030 0.07471386 0.06654450 0.05564769 0.04163290 0.02840767 0.01613022 0.00644648
0.00186626 0.00039651 0.00006081 0.00000360

RESULTING DISTRIBUTION FUNCTION

0.00000360 0.00006081 0.00025360 0.00052884 0.00121848 0.00283651 0.00567615 0.01021895 0.01643697 0.02459184
0.03547079 0.05080776 0.07239741 0.10078614 0.13544834 0.17837089 0.23100589 0.29177182 0.36372228 0.44731499
0.53720991 0.62599900 0.70820930 0.78292316 0.84946766 0.90511535 0.94674825 0.97515591 0.99128613 0.99773261
0.99959888 0.99993538 0.99999620 0.99999980

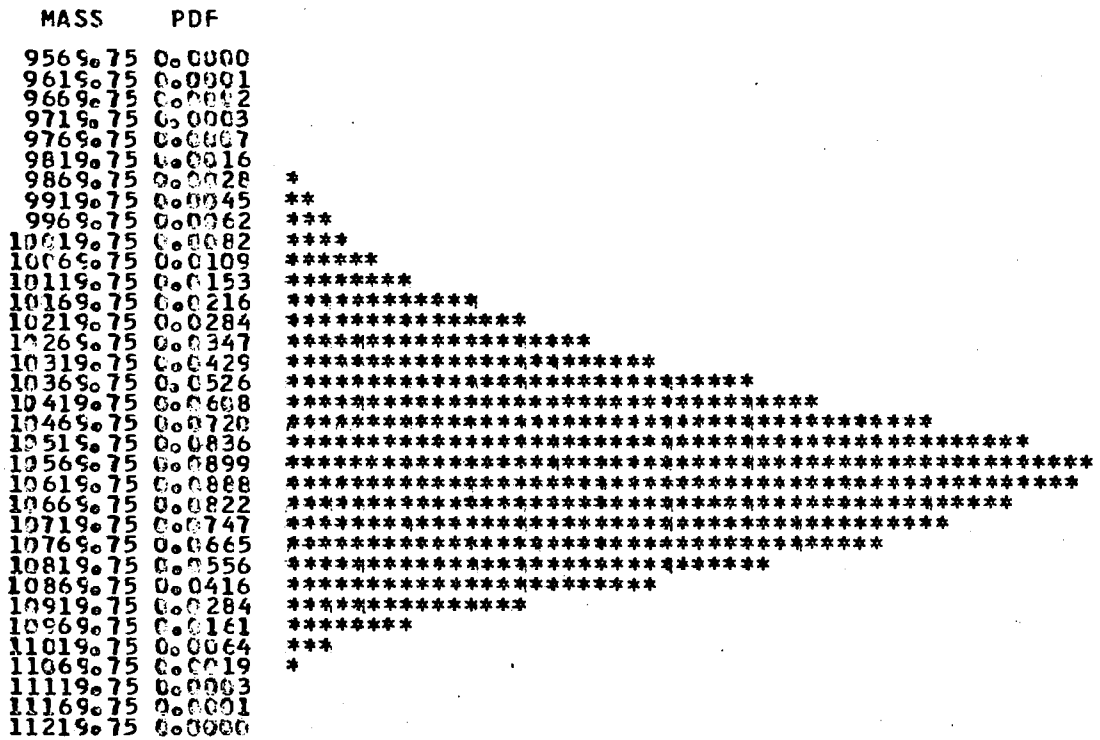
RELEVANT DATA

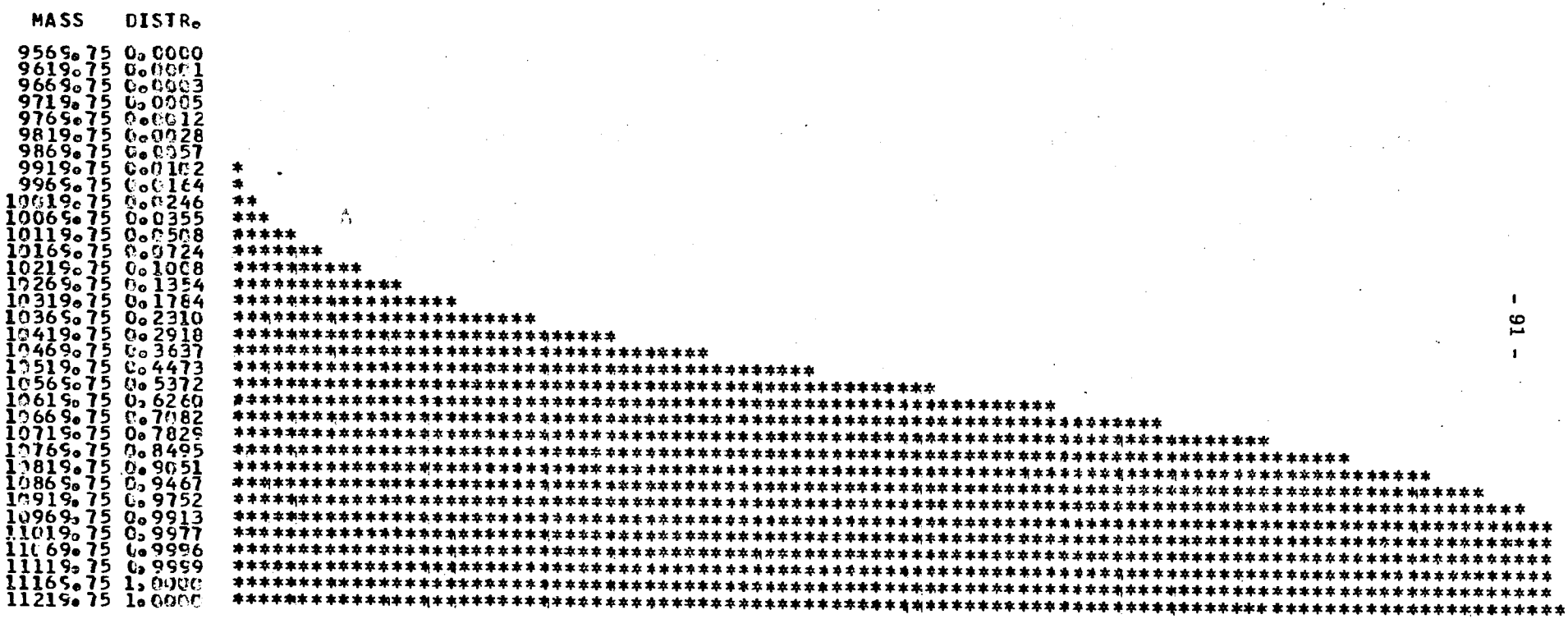
34 NUMBER OF THE HISTOGRAM POINTS
9569.75 ABSCISSA OF THE FIRST POINT
10555.33 MEAN VALUE OF THE DISTRIBUTION
230.436 STANDARD DEVIATION OF THE MEAN

RESULT OF THE CONVOLUTION +

CONFIDENCE INTERVALS

	P(X)	X-MEAN	X
1	2.5	-533.71	10021.63
2	5.0	-438.22	10117.12
3	10.0	-336.97	10218.37
4	20.0	-215.04	10340.30
5	80.0	177.25	10732.58
6	90.0	259.82	10815.15
7	95.0	320.14	10875.47
8	97.5	363.93	10919.27


MASS PDF
9569.75 0.0000
9619.75 0.0001
9669.75 0.0002
9719.75 0.0003
9769.75 0.0007
9819.75 0.0016
9869.75 0.0028
9919.75 0.0045
9969.75 0.0062
10019.75 0.0082
10069.75 0.0109
10119.75 0.0153
10169.75 0.0216
10219.75 0.0284
10269.75 0.0347
10319.75 0.0429
10369.75 0.0526
10419.75 0.0608
10469.75 0.0720
10519.75 0.0836
10569.75 0.0899
10619.75 0.0888
10669.75 0.0822
10719.75 0.0747
10769.75 0.0665
10819.75 0.0556
10869.75 0.0416
10919.75 0.0284
10969.75 0.0161
11019.75 0.0064
11069.75 0.0019
11119.75 0.0003
11169.75 0.0001
11219.75 0.0000


MASS DISTR.
9569.75 0.0000
9619.75 0.0001
9669.75 0.0003
9719.75 0.0005
9769.75 0.0012
9819.75 0.0028
9869.75 0.0057
9919.75 0.0102
9969.75 0.0164
10019.75 0.0246
10069.75 0.0355
10119.75 0.0508
10169.75 0.0724
10219.75 0.1008
10269.75 0.1354
10319.75 0.1784
10369.75 0.2310
10419.75 0.2918
10469.75 0.3637
10519.75 0.4473
10569.75 0.5372
10619.75 0.6260
10669.75 0.7082
10719.75 0.7829
10769.75 0.8495
10819.75 0.9051
10869.75 0.9467
10919.75 0.9752
10969.75 0.9913
11019.75 0.9977
11069.75 0.9996
11119.75 0.9999
11165.75 1.0000
11219.75 1.0000

RELEVANT DATA OF THE P.D.F. *1*

34 NUMBER OF THE HISTOGRAM POINTS
9569.75 ABSCISSA OF THE FIRST POINT
10555.33 MEAN VALUE OF THE DISTRIBUTION
230.436 STANDARD DEVIATION OF THE MEAN

0.00000360 0.00005721 0.00019279 0.00027523 0.00068965 0.00161802 0.00283965 0.00454279 0.00621802 0.00815407
0.01087976 0.01533697 0.02158965 0.02838873 0.03466220 0.04292255 0.05263420 0.06076673 0.07195046 0.08359270
0.08989492 0.08878909 0.08221030 0.07471386 0.06654450 0.05564769 0.04163290 0.02840767 0.01613022 0.00644648
0.00186626 0.00033651 0.00006081 0.00000360

RELEVANT DATA OF THE P.D.F. *2*

33 NUMBER OF THE HISTOGRAM POINTS
-431.90 ABSCISSA OF THE FIRST POINT
431.85 MEAN VALUE OF THE DISTRIBUTION
308.220 STANDARD DEVIATION OF THE MEAN

0.00010000 0.00080000 0.00180000 0.00500000 0.00900000 0.01510000 0.01910000 0.02190000 0.02160000 0.02650000
0.03210000 0.03280000 0.04130000 0.04390000 0.04750000 0.05460000 0.06240000 0.06800000 0.06500000 0.06310000
0.05690000 0.05150000 0.04580000 0.03850000 0.03970000 0.03230000 0.03180000 0.02780000 0.02120000 0.01360000
0.00700000 0.00120000 0.00010000

\+ CONVOLUTION REQUIRED BETWEEN P.D.F. *1* AND P.D.F. *2*

RESULT OF THE CONVOLUTION +

RESULTING P.C.F.

0.00000000	0.00000001	0.00000007	0.00000030	0.00000095	0.00000274	0.00000686	0.00001565	0.00003283	0.00006395
0.00011650	0.00019878	0.00031942	0.00048925	0.00072704	0.00105598	0.00150820	0.00211584	0.00290597	0.00390952
0.00516182	0.00670803	0.00858075	0.01079121	0.01332798	0.01615417	0.01919380	0.02240202	0.02576955	0.02922742
0.03270025	0.03610099	0.03933693	0.04232909	0.04500584	0.04729242	0.04905789	0.05015241	0.05044075	0.04990383
0.04856523	0.04644998	0.04367585	0.04036290	0.03665621	0.03270971	0.02866558	0.02464697	0.02074715	0.01704786
0.01362664	0.01056740	0.00790141	0.00564355	0.00380403	0.00237487	0.00134515	0.00067510	0.00028981	0.00010164
0.00002838	0.00000614	0.00000107	0.00000013	0.00000001	0.00000000				

RESULTING DISTRIBUTION FUNCTION

0.00000000	0.00000001	0.00000008	0.00000038	0.00000134	0.00000408	0.00001094	0.00002659	0.00005942	0.00012337
0.00023988	0.00043866	0.00075808	0.00124733	0.00197438	0.00303036	0.00453856	0.00665440	0.00956037	0.01346989
0.01863172	0.02533974	0.03392049	0.04471170	0.05803968	0.07419385	0.09338765	0.11578967	0.14155922	0.17078663
0.20348688	0.23958787	0.27892480	0.32125389	0.36625973	0.41355215	0.46261004	0.51276246	0.56320320	0.61310763
0.66167226	0.70812224	0.75179809	0.79216099	0.82881719	0.86152691	0.89019248	0.91483945	0.93558660	0.95263446
0.96626110	0.97682850	0.98472991	0.99037347	0.99417750	0.99655237	0.99789752	0.99857262	0.99886243	0.99896407
0.99899245	0.99899859	0.99899966	0.99899979	0.99899980	0.99899980				

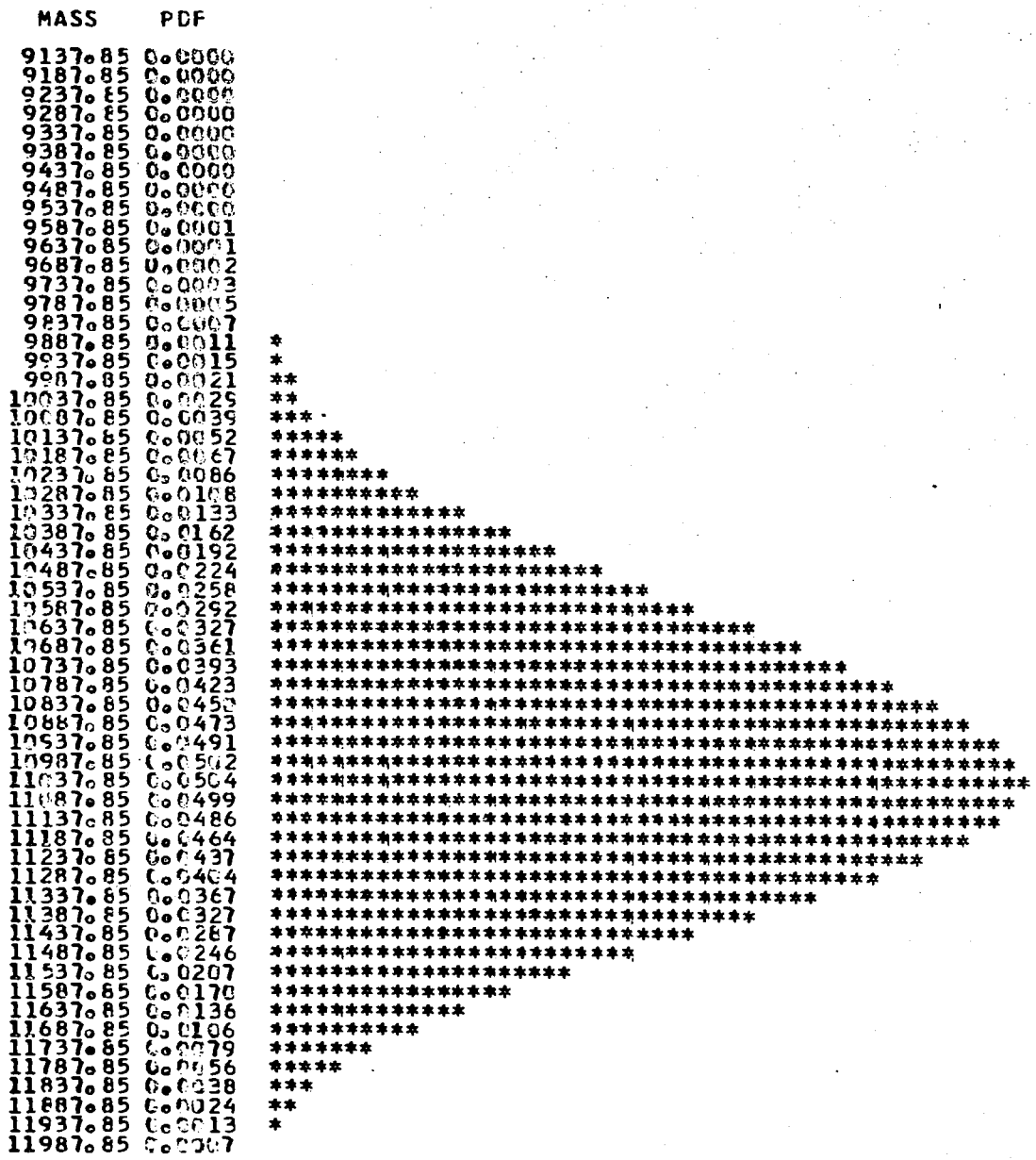
RELEVANT DATA

66	NUMBER OF THE HISTOGRAM POINTS
9137.85	ABSCISSA OF THE FIRST POINT
10985.11	MEAN VALUE OF THE DISTRIBUTION
389.107	STANDARD DEVIATION OF THE MEAN

RESULT OF THE CONVOLUTION +

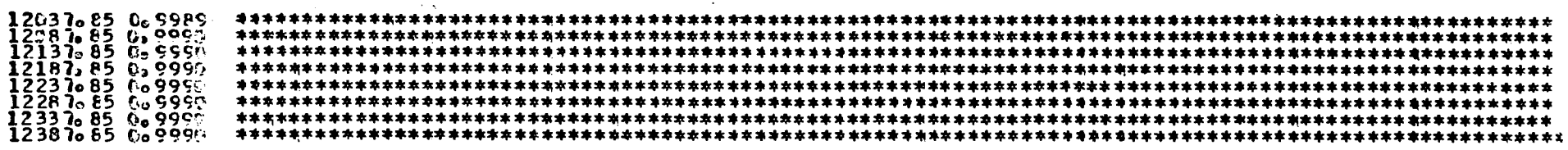
CONFIDENCE INTERVALS

	P(X)	X-MEAN	X
1	2.5	-799.79	10185.32
2	5.0	-677.42	10307.69
3	10.0	-632.50	10452.61
4	20.0	-352.59	10632.52
5	80.0	313.43	11298.54
6	90.0	472.64	11457.75
7	95.0	595.01	11580.12
8	97.5	694.09	11679.20


MASS PDF
9137.85 0.0000
9187.85 0.0000
9237.85 0.0000
9287.85 0.0000
9337.85 0.0000
9387.85 0.0000
9437.85 0.0000
9487.85 0.0000
9537.85 0.0000
9587.85 0.0001
9637.85 0.0001
9687.85 0.0002
9737.85 0.0003
9787.85 0.0005
9837.85 0.0007
9887.85 0.0011 *
9937.85 0.0015 *
9987.85 0.0021 **
10037.85 0.0029 **
10087.85 0.0039 ***
10137.85 0.0052 *****
10187.85 0.0067 ******
10237.85 0.0086 ********
10287.85 0.0108 **********
10337.85 0.0133 *************
10387.85 0.0162 ****************
10437.85 0.0192 ********************
10487.85 0.0224 ************************
10537.85 0.0258 ***************************
10587.85 0.0292 *****************************
10637.85 0.0327 ********************************
10687.85 0.0361 ************************************
10737.85 0.0393 **
10787.85 0.0423 **
10837.85 0.0450 **
10887.85 0.0473 **
10937.85 0.0491 **
10987.85 0.0502 ***
11037.85 0.0504 ***
11087.85 0.0499 **
11137.85 0.0486 ***
11187.85 0.0464 ***
11237.85 0.0437 ***
11287.85 0.0404 **
11337.85 0.0367 ************************************
11387.85 0.0327 ********************************
11437.85 0.0287 ****************************
11487.85 0.0246 ************************
11537.85 0.0207 ********************
11587.85 0.0170 ****************
11637.85 0.0136 *************
11687.85 0.0106 **********
11737.85 0.0079 *******
11787.85 0.0056 *****
11837.85 0.0038 ***
11887.85 0.0024 **
11937.85 0.0013 *
11987.85 0.0007

12037.85	0.0053
12087.85	0.0001
12137.85	0.0000
12187.85	0.0000
12237.85	0.0000
12287.85	0.0000
12337.85	0.0000
12387.85	0.0000

MASS	DISTR.	
9137.85	0.0000	
9187.85	0.0000	
9237.85	0.0000	
9287.85	0.0000	
9337.85	0.0000	
9387.85	0.0000	
9437.85	0.0000	
9487.85	0.0000	
9537.85	0.0001	
9587.85	0.0001	
9637.85	0.0002	
9687.85	0.0004	
9737.85	0.0008	
9787.85	0.0012	
9837.85	0.0020	
9887.85	0.0030	
9937.85	0.0045	
9987.85	0.0067	
10037.85	0.0096	
10087.85	0.0135	*
10137.85	0.0186	*
10187.85	0.0253	**
10237.85	0.0339	***
10287.85	0.0447	****
10337.85	0.0580	*****
10387.85	0.0742	*******
10437.85	0.0934	*********
10487.85	0.1158	**********
10537.85	0.1416	************
10587.85	0.1708	**************
10637.85	0.2035	********************
10687.85	0.2396	************************
10737.85	0.2789	*****************************
10787.85	0.3213	**********************************
10837.85	0.3663	**************************************
10887.85	0.4136	**
10937.85	0.4626	**
10987.85	0.5128	**
11037.85	0.5632	**
11087.85	0.6131	**
11137.85	0.6617	**
11187.85	0.7081	**
11237.85	0.7518	**
11287.85	0.7922	**
11337.85	0.8288	**
11387.85	0.8615	**
11437.85	0.8902	**
11487.85	0.9148	**
11537.85	0.9356	**
11587.85	0.9526	**
11637.85	0.9663	**
11687.85	0.9768	**
11737.85	0.9847	**
11787.85	0.9904	**
11837.85	0.9942	**
11887.85	0.9966	**
11937.85	0.9979	**
11987.85	0.9986	***



RELEVANT DATA OF THE P.D.F. *1*

66 NUMBER OF THE HISTOGRAM POINTS
9137.85 ABSCISSA OF THE FIRST POINT
10985.11 MEAN VALUE OF THE DISTRIBUTION
389.107 STANDARD DEVIATION OF THE MEAN

0.00000000 0.00000001 0.00000007 0.00000030 0.00000095 0.00000274 0.00000686 0.00001565 0.00003283 0.00006395
0.00011650 0.00019878 0.00031942 0.00048925 0.00072704 0.00105598 0.00150828 0.00211584 0.00290597 0.00390952
0.00516182 0.00670803 0.00858075 0.01079121 0.01332798 0.01615417 0.01919380 0.02240202 0.02576555 0.02922742
0.03270025 0.03610059 0.03933693 0.04232909 0.04500584 0.04729242 0.04905789 0.05015241 0.05044075 0.04990383
0.04856523 0.04644998 0.04367585 0.04036290 0.03665621 0.03270971 0.02866558 0.02464697 0.02074715 0.01704786
0.01362664 0.01056740 0.00790141 0.00564355 0.00380483 0.00237487 0.00134515 0.00067510 0.00028981 0.00010164
0.00002838 0.00000614 0.00000107 0.00000013 0.00000001 0.00000000

RELEVANT DATA OF THE P.D.F. *2*

18 NUMBER OF THE HISTOGRAM POINTS
10315.00 ABSCISSA OF THE FIRST POINT
11190.00 MEAN VALUE OF THE DISTRIBUTION
141.000 STANDARD DEVIATION OF THE MEAN

0.00227790 0.00424953 0.01015516 0.02142759 0.03992106 0.06567166 0.09539098 0.12234697 0.13855934 0.13855854
0.12234697 0.09539098 0.06567166 0.03992106 0.02142759 0.01015516 0.00424953 0.00227790

2-1 CONVOLUTION REQUIRED BETWEEN P.D.F. *1* AND P.D.F. *2*

RESULT OF THE CONVOLUTION 2-1

RESULTING P.D.F.

0.00000000	0.00000000	0.00000000	0.00000000	0.00000002	0.00000010	0.00000044	0.00000156	0.00000474	0.00001271
0.00003085	0.00006875	0.00014213	0.00027454	0.00049835	0.00085422	0.00138877	0.00215121	0.00318757	0.00453767
0.00622770	0.00827368	0.01067388	0.01341110	0.01645193	0.01974694	0.02323115	0.02682480	0.03043515	0.03395854
0.03728393	0.04029838	0.04289345	0.04497280	0.04645979	0.04736407	0.04768566	0.04761504	0.04729440	0.04690392
0.04220221	0.03971508	0.03693038	0.03393408	0.03080003	0.02762861	0.02446592	0.02138314	0.01843506	0.01567138
0.01312755	0.01083340	0.00880457	0.00704641	0.00555278	0.00432825	0.00329059	0.00247350	0.00182912	0.00132991
0.00094994	0.00066579	0.00045711	0.00030672	0.00020366	0.00012746	0.00007843	0.00004658	0.00002662	0.00001459
0.00000764	0.00000381	0.00000180	0.00000080	0.00000034	0.00000013	0.00000005	0.00000002	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000							

RESULTING DISTRIBUTION FUNCTION

0.00000000	0.00000000	0.00000000	0.00000000	0.00000002	0.00000013	0.00000057	0.00000214	0.00000687	0.00001958
0.00005043	0.00011919	0.00026131	0.00053586	0.00103421	0.00188843	0.00327731	0.00542052	0.00860809	0.01315316
0.01938087	0.02765455	0.03832843	0.05173952	0.06819146	0.08793846	0.11116955	0.13799437	0.16842955	0.20238803
0.23967196	0.27997134	0.32226379	0.36683659	0.41429638	0.46467845	0.51761611	0.57261195	0.62936835	0.68634027
0.74289424	0.79825756	0.85187894	0.90312203	0.95193006	0.99755867	1.04023459	1.07940773	1.11524359	1.14751496
1.17706133	1.20472712	1.23018423	1.25384965	1.27569155	1.29581691	1.31435744	1.33144442	1.34697763	1.36119139
1.37389286	1.38535666	1.39569846	1.40499927	1.41329960	1.42069973	1.42729978	1.43315579	1.43835980	1.44296522
1.44702980	1.45060580	1.45374134							

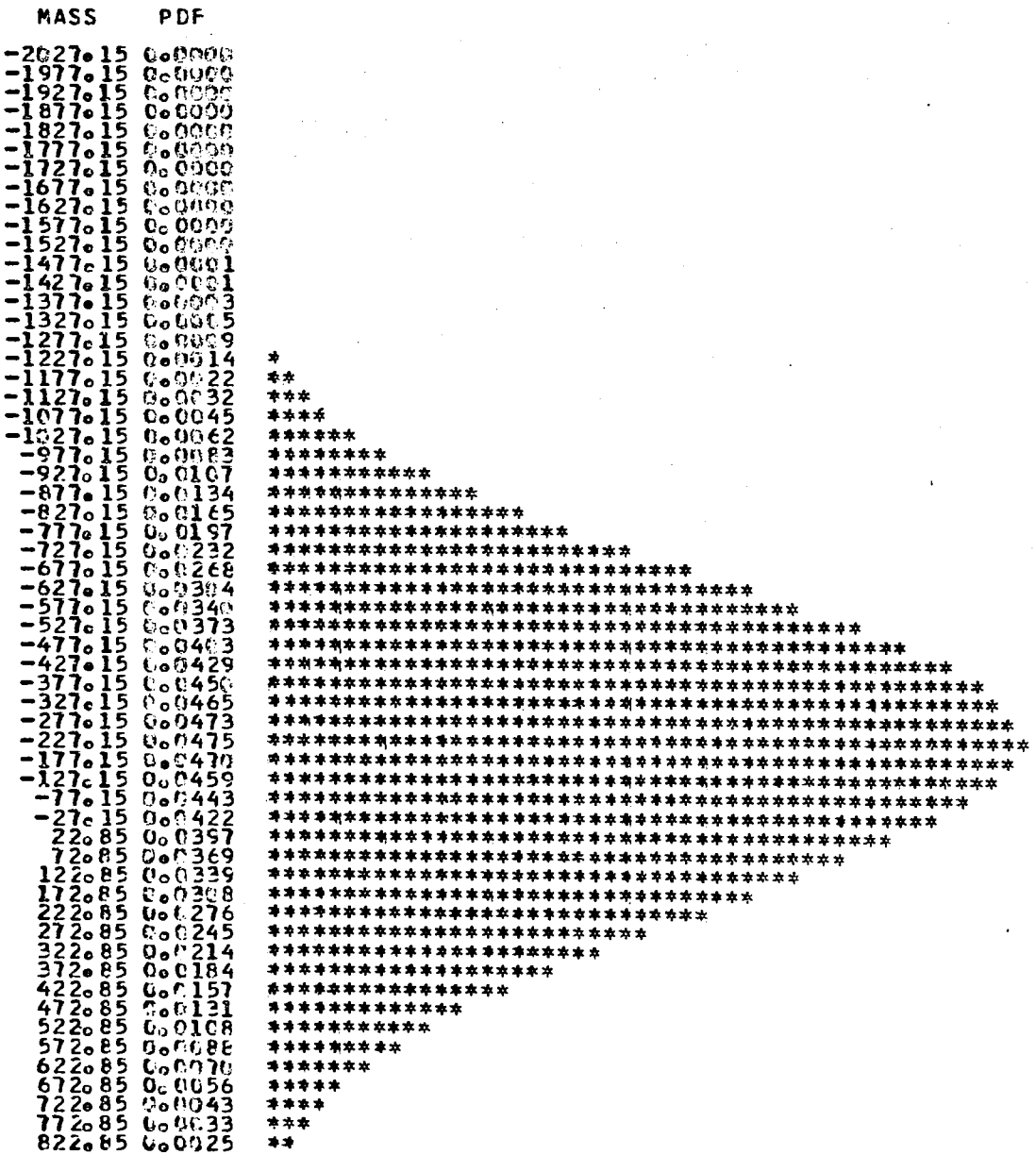
RELEVANT DATA

```
      83 NUMBER OF THE HISTOGRAM POINTS
-2027.15 ABSCISSA OF THE FIRST POINT
 -253.18 MEAN VALUE OF THE DISTRIBUTION
  413.879 STANDARD DEVIATION OF THE MEAN
```

RESULT OF THE CONVOLUTION 2-1

CONFIDENCE INTERVALS

	P(X)	X-MEAN	X
1	2.5	-750.01	-993.19
2	5.0	-680.45	-883.64
3	10.0	-548.91	-751.19
4	20.0	-377.48	-580.67
5	80.0	327.46	124.27
6	90.0	518.07	314.88
7	95.0	673.59	470.40
8	97.5	809.52	606.34


MASS PDF
-2027.15 0.0000
-1977.15 0.0000
-1927.15 0.0000
-1877.15 0.0000
-1827.15 0.0000
-1777.15 0.0000
-1727.15 0.0000
-1677.15 0.0000
-1627.15 0.0000
-1577.15 0.0000
-1527.15 0.0000
-1477.15 0.0001
-1427.15 0.0001
-1377.15 0.0003
-1327.15 0.0005
-1277.15 0.0009
-1227.15 0.0014 *
-1177.15 0.0022 **
-1127.15 0.0032 ***
-1077.15 0.0045 ****
-1027.15 0.0062 ******
-977.15 0.0083 ********
-927.15 0.0107 **********
-877.15 0.0134 **********
-827.15 0.0165 **********
-777.15 0.0197 **********
-727.15 0.0232 **********
-677.15 0.0268 **********
-627.15 0.0304 **********
-577.15 0.0340 **********
-527.15 0.0373 **********
-477.15 0.0403 **********
-427.15 0.0429 **********
-377.15 0.0450 **********
-327.15 0.0465 **********
-277.15 0.0473 **********
-227.15 0.0475 **********
-177.15 0.0470 **********
-127.15 0.0459 **********
-77.15 0.0443 **********
-27.15 0.0422 **********
22.85 0.0397 **********
72.85 0.0369 **********
122.85 0.0339 **********
172.85 0.0308 **********
222.85 0.0276 **********
272.85 0.0245 **********
322.85 0.0214 **********
372.85 0.0184 **********
422.85 0.0157 **********
472.85 0.0131 **********
522.85 0.0108 **********
572.85 0.0088 **********
622.85 0.0070 **********
672.85 0.0056 **********
722.85 0.0043 **********
772.85 0.0033 **********
822.85 0.0025 **********

872.	85	0.0018 *
922.	85	0.0013 *
972.	85	0.0009 *
1022.	85	0.0007
1072.	85	0.0005
1122.	85	0.0003
1172.	85	0.0002
1222.	85	0.0001
1272.	85	0.0001
1322.	85	0.0000
1372.	85	0.0000
1422.	85	0.0000
1472.	85	0.0000
1522.	85	0.0000
1572.	85	0.0000
1622.	85	0.0000
1672.	85	0.0000
1722.	85	0.0000
1772.	85	0.0000
1822.	85	0.0000
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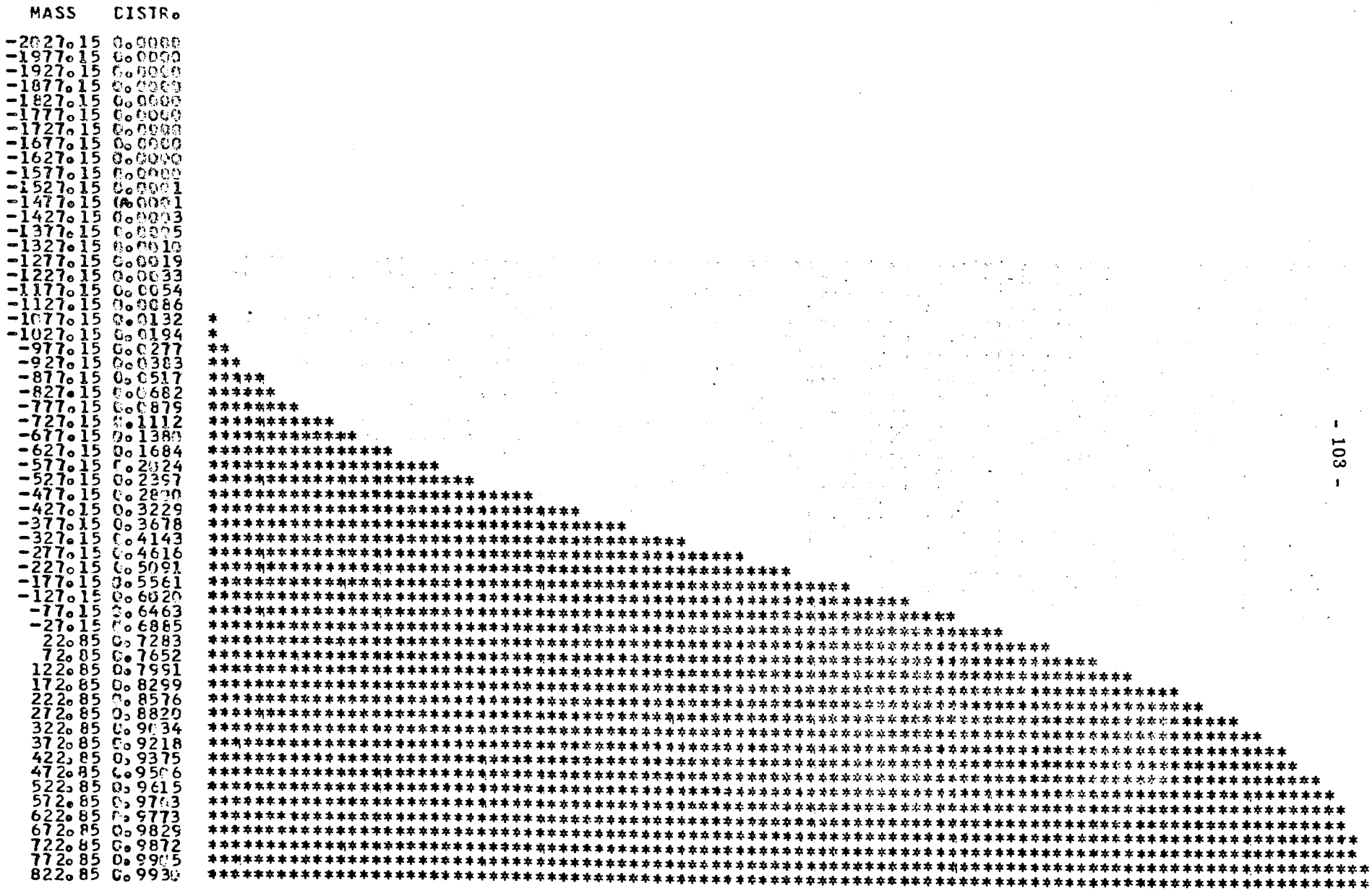
2072.	85	0.0000


MASS DISTR.
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-1727.15 0.0000
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-1627.15 0.0000
-1577.15 0.0000
-1527.15 0.0001
-1477.15 0.0001
-1427.15 0.0003
-1377.15 0.0005
-1327.15 0.0010
-1277.15 0.0019
-1227.15 0.0033
-1177.15 0.0054
-1127.15 0.0086
-1077.15 0.0132
-1027.15 0.0194
-977.15 0.0277
-927.15 0.0383
-877.15 0.0517
-827.15 0.0682
-777.15 0.0879
-727.15 0.1112
-677.15 0.1380
-627.15 0.1684
-577.15 0.2024
-527.15 0.2397
-477.15 0.2800
-427.15 0.3229
-377.15 0.3678
-327.15 0.4143
-277.15 0.4616
-227.15 0.5091
-177.15 0.5561
-127.15 0.6020
-77.15 0.6463
-27.15 0.6885
22.85 0.7283
72.85 0.7652
122.85 0.7991
172.85 0.8299
222.85 0.8576
272.85 0.8820
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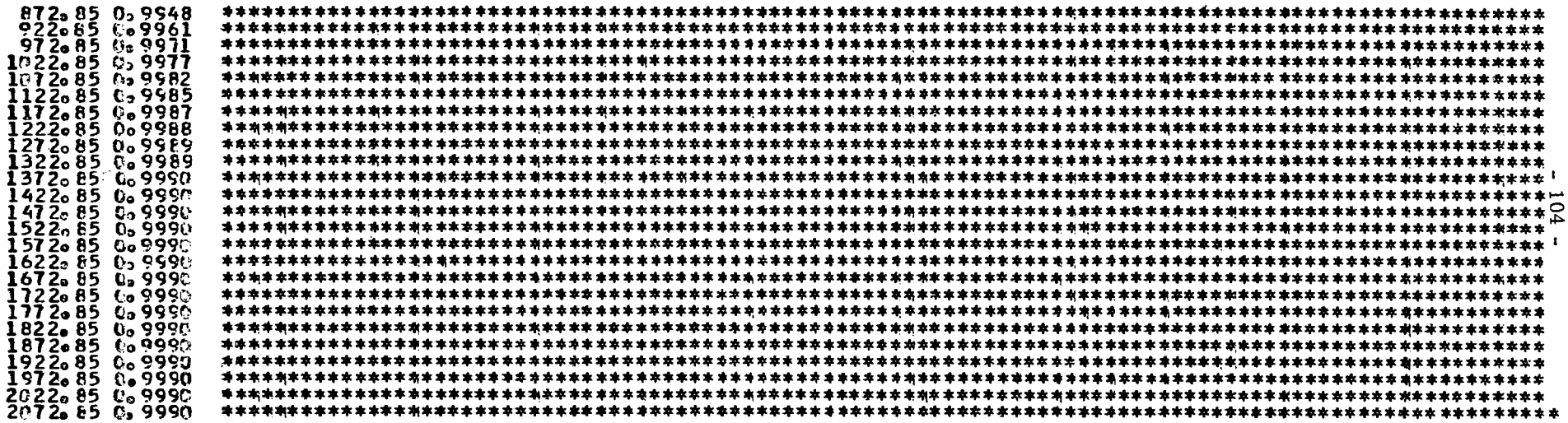
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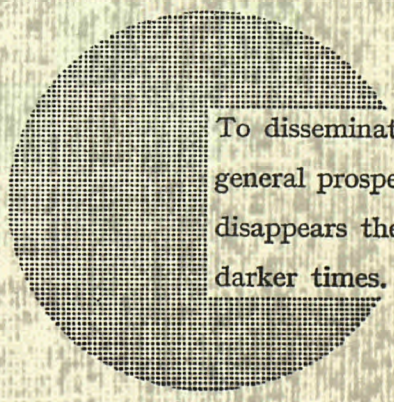

To disseminate knowledge is to disseminate prosperity — I mean general prosperity and not individual riches — and with prosperity disappears the greater part of the evil which is our heritage from darker times.

Alfred Nobel

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